The Red Book of Building Material

Contracting Division

Fireproofing Specialities

Roof and Floor Constructions

United States Gypsum Company

300 West Adams Street, Chicago

UNITED STATES GYPSUM COMPANY

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300 West Adams Street, CHICAGO, ILL.

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PRODUCTS DESCRIBED IN OTHER CATALOGUES

See Sweet's Manufacturers' Index for:

(1) Standard X Plastering System; Metal Laths and Accessories; Rock-lath; complete line of Red Top Gypsum Plasters: Red Top Finishing Lime; Red Top Exterior Oriental Stucco; Sheetrock (Wall Board).
(2) Econo Expanded Metal.
(3) Insulation Products.
(4) Architectural Acoustics, Noise Abatement and Sound Control.
(5) U.S.G. Paint Products.
(6) Chromite—Sheet Metal Wall Tile.

UNITED STATES GYPSUM COMPANY CONTRACTING DIVISION

Gypsum Roof Tile, Gypsum Roof Systems, Gypsum Floor Systems, Gypsum Partition Tile, Gypsum Column, Beam and Girder Fireproofing

Experience and Facilities

The UNITED STATES GYPSUM COMPANY is a pioneer in the development of gypsum tile and poured gypsum constructions for fireproof buildings. More than fifteen years ago the company experimented with reinforced gypsum blocks in roof construction in its own plants in an endeavor to increase the insulation value and stop condensation. So successful were these installations that the company decided to offer the roofs to other manufacturers and builders. At present over 100,000,000 sq. ft. of gypsum roofs are in successful use, and many representative firms have standardized on gypsum roofs. A list of installations will be sent on request.

Standardized methods and rigid inspection result in uniform quality. Complete control of every operation, from the mine to the erection of the material in the building, is made possible by the close co-ordination of engineering, manufacturing and contracting service.

The company's twenty-two sales offices—see foreword—located in the important building centers, assure adequate architectural service. The numerous manufacturing plants, strategically located, assure exceptional national distribution facilities.

Engineering Service

The UNITED STATES GYPSUM COMPANY employs a staff of competent engineers experienced in floor and roof design. To secure the most *practical and economical designs best adapted to the particular type of building,* we strongly recommend consultation with our local sales and service office *at the time the building is designed.* A word to your local U.S.G. representative will place our engineering department promptly at your disposal without obligation.

U S G

TRADE-MARK

Erection Service

The UNITED STATES GYPSUM COMPANY maintains a Contracting Division which contracts for the complete construction of gypsum roofs, floors, partitions, and fireproofing. Our crews of experienced field superintendents and workmen are equipped to erect U.S.G. products on any type of building anywhere, including the furnishing and erection of any necessary T-iron or rail subpurlins on either new or alteration work. We also contract for sound insulation treatment.

The employment of our construction organization assures the architect of rapid, continuous progress with the maximum economy and the highest type of workmanship and careful, intelligent supervision. During the past fifteen years the UNITED STATES GYPSUM COMPANY has installed more than fifty million square feet of gypsum roof construction throughout the country on all types of buildings.

Estimates furnished upon request.

GYPSUM—GENERAL TECHNICAL DATA

Gypsum

Chemically, gypsum is hydrous calcium sulphate $CaSO_4(2H_2O)$. It is a widely distributed mineral found in rock formation. The rock gypsum is crushed, ground and then calcined, which drives off a part of the molecular water, forming the hemihydrate or plaster of paris. This product, when mixed with water, takes up or combines with the same amount as was driven off in the calcination process.

Gypsum is one of the most ancient of building materials. The Greeks used gypsum in Pliny's time (23-79 A.D.). The Temple of Apollo at Bassae (470 B.C.) affords an excellent example of the use and permanent structural qualities of gypsum. The Egyptian pyramids contain plaster works of gypsum, executed at least 4,000 years ago.

Structolite

An exclusive UNITED STATES GYPSUM COMPANY product developed in 1916. It consists of calcined gypsum subjected to certain mechanical and chemical treatments which produce a very dense, high grade product named "Structolite" because of its *great structural strength* and *comparative light weight.*

Fireproof

The superior qualities of gypsum as a fireproof building material have been definitely established by numerous tests made by the Underwriters' Laboratories, Inc., and by the bureau of buildings in many of the larger cities.

Note: See the results of the Underwriters' Laboratories Fire and Water Tests in the following reports: Retardant Reports No. 378 (June 22, 1910), No. 1095 (April, 1918), No. 973 (July 17, 1918). Other authentic reports will be furnished on application.

The temperature of the slab (whether of poured or precast gypsum or Structolite) cannot exceed 212° F. except on the surface exposed to the fire. This is due to the fact that the water of crystallization in the gypsum is vaporized during the application of fire to

Continued on next page

it, and as the gypsum slowly calcines, the cellular structure fills with steam. It is this barrier of calcined material which stubbornly resists the progress of the fire.

Light Weight

Gypsum is the lightest of the structural building materials, having approximately 40% of the weight of concrete.

Where used structurally in floor and roof slabs the light weight of gypsum, combined with strength, reflects decided economies in all supporting members including foundations—savings which frequently amount to formidable sums when freight, haul, hoist, erection and interest on the investment are properly considered.

Insulation

Gypsum with its close knit air confining cells has the highest insulating value of any fireproof cementitious structural building material. It thus combines insulation and strength in one homogeneous substance.

Present day efficiency of plant operation demands a non-combustible roof deck which conserves heat in winter, and maintains cool working conditions even in the hottest summer weather. Gypsum roof constructions fulfill this demand at a minimum cost.

Heat losses through gypsum roof decks are minimized, and the temperature at the undersurface of the roof remains practically the same as the interior of the building, regardless of outside temperature. This tends to eliminate condensation or "sweating" and dripping under moist air conditions.

For "Gypsum Insulation Data" see below.

Resistance to Sulphur Gases

As sulphur dioxide gas is commonly encountered in manufacturing plants, power plants, forge shops, foundries, roundhouses, etc., roofs, particularly, are often subjected to very severe acid conditions when in combination with high humidity. Most structural materials are readily and rapidly attacked by sulphur dioxide gas, resulting in disintegration and ultimate failure.

Authentic tests upon reinforced gypsum roof constructions indicate that under continuous subjection to sulphur fumes the gypsum mass actually increases in strength. The steel reinforcing is treated to prevent progressive corrosion.

Conclusive test data will be furnished on application.

GYPSUM INSULATION DATA

Heat Conductivity Coefficients

In order to appreciate fully the superiority of gypsum as an insulator, it is necessary to understand the principle underlying the calculation of heat losses through various materials.

The amount of heat transmitted through a roof is calculated from the following formula, which combines: (1) the admission of heat from the air into the surface of the roof; (2) the transmission of heat through the roof; and (3) the emission of heat from the other surface of the roof into the air.

$$U = \frac{1}{\frac{1}{K1} + \frac{1}{K2} + \frac{X1}{C1} + \frac{X2}{C2} + \frac{X3}{C3} + \text{etc.}}$$

U = B.t.u.'s transmitted per hour per square foot per degree difference in temperature.
K1 = Inside surface coefficient (average).
K2 = Outside surface coefficient with 15 miles per hour wind (average).
X = Thickness of individual material, in inches.
C = Coefficient of conductivity per inch thickness of individual materials, per hour, per sq. ft., per degree difference.

The following table gives the coefficient of K1 and K2 generally used, together with the coefficient C for a number of materials as determined by recognized authorities, as given in A.S.H.&V.E. Guide.

K1—Average	1.34	(B.t.u.'s)
K2—Average	4.02	(B.t.u.'s)
C—Values per inch thickness, except as noted:		
Stone Concrete (1-2-4 Mix)	8.3	(B.t.u.'s)
Cinder Concrete	5.2	(B.t.u.'s)
Pine Plank	1.00	(B.t.u.'s)
Insulite Board	0.34	(B.t.u.'s)
Gypsum Fiber Concrete (Pyrofill)	1.66	(B.t.u.'s)
Sheetrock or Plasterboard (per ⅜ in. thickness)	3.6	(B.t.u.'s)
(Precast) Gypsum Roof Tile	2.4	(B.t.u.'s)
5 Ply Tar and Gravel Roofing	1.325	(B.t.u.'s)

In considering the actual insulating value of a roof it should be borne in mind that with gypsum a homogeneous, structural, fireproof slab is provided.

Heat Saving (Examples)

The following example shows the saving made possible by the use of a 3-in. Sheetrock-Pyrofill roof in place of a 3-in. concrete roof slab.

Assume a building of 100,000 sq. ft. of roof area in which it is necessary to maintain a constant inside temperature of 70° F. twelve hours per day. The lowest outside temperature will be assumed as 0° F. and the number of days requiring heat 210.

The total heat loss through the gypsum roof will be $.318 \times 100{,}000 \times 70 \times 12 = 26{,}700{,}000$ B.t.u.'s per 12-hour day. The total heat loss per year (210 heating days) is $26{,}700{,}000 \times 210 = 5{,}600{,}000{,}000$ B.t.u.'s.

On the same basis of calculations, the heat loss due to 3-in. concrete roof will be $.61 \times 100{,}000 \times 70 \times 12 \times 210 = 10{,}760{,}000{,}000$ B.t.u.'s per year (210 heating days). (See table on page 48 for heat transmitted through these roofs.)

The amount of heat saved by the use of gypsum is the difference, or 5,160,000,000 B.t.u.'s assuming that an outside temperature of zero will be constant throughout the 210 days. However, actual tests by heating engineers indicate that the actual saving is about 30% of the above, due to the fact that the average outside temperature during the 210 heating days is considerably above zero.

Therefore the actual saving is 30% of B.t.u.'s $5{,}160{,}000{,}000 = 1{,}550{,}000{,}000$ B.t.u.'s.

Fuel Saving (Example)

Assuming the use of a grade of industrial coal producing 8,000 B.t.u's per pound and an efficiency of 70% in the heating plant, the coal saved per year is

$$\frac{1{,}550{,}000{,}000}{8{,}000 \times 2{,}000 \times .70} = 138 \text{ tons of coal}$$

Radiation Saving (Example)

By the same line of reasoning a substantial saving can be effected in the heating equipment. The amount of heat saved per hour by the Sheetrock-Pyrofill roof will be $(.61 - .318) \times 100{,}000 \times 70° = 2{,}044{,}000$ B.t.u.'s per hour, at maximum load on heating plant.

A square foot of radiation surface in a steam heating plant operating at a 5-lb. steam pressure will emit 250 B.t.u.'s per hour.

Therefore, the amount of radiation saved is

$$\frac{2{,}044{,}000}{250} = 8{,}176 \text{ sq. ft.}$$

Continued on next page

SHEETROCK-PYROFILL ROOF CONSTRUCTION

Description

Note: For "Gypsum—General Technical Data," see page 1.

Note: For Sheetrock, see Sweet's Manufacturers' Index.

General—Sheetrock-Pyrofill System of Roof construction consists of permanent Sheetrock forms and Pyrofill (Gypsum Fiber Concrete) reinforced with an electrically-welded, galvanized steel fabric supported on subpurlins clipped to the main structural steel purlins. It is sold only completely erected by the Contracting Division of the United States Gypsum Company.

Subpurlins—The subpurlins (either tees or light rail sections) are laid at right angles to main purlins and are spaced approximately 32½ in. on centers, varying slightly, dependent on weight of rail and method of fastening used. (See details, pages 5, 6 and 7).

Sheetrock Forms—On the bottom flanges of the subpurlin are laid panels of Sheetrock mill-made in lengths (maximum 10 ft.) equal to the main purlin spacing. All joints on the undersurface are hidden, and a neat, smooth ceiling results. If a greater degree of insulation or greater sound absorption value is desired, ½ in. Insulite Board may be substituted for the Sheetrock.

Reinforcement—Consists of a continuous electrically-welded galvanized steel fabric (specially made to U.S.G. specifications) made with No. 12 main longitudinal wires 4 in. on centers and No. 14 transverse wires 8 in. on centers having a section area of .026 sq. in. This reinforcement is laid on top of the Sheetrock with the length (longitudinal wires) at right angles to the subpurlins.

Pyrofill—Pyrofill (Gypsum Fiber Concrete) consists of gypsum stucco and water and not to exceed 12½ lb. of fiber (usually wood planer shavings) to 87½ lb. of calcined gypsum. It weighs but 55 lb. per cu. ft.

Over and bonding to the Sheetrock forms, the Pyrofill is poured, completely surrounding the reinforcement, and screeded to the required thickness.

Curbs, etc.—Curbs above and below monitors or sawtooth sash or elsewhere where required may be constructed of Sheetrock-Pyrofill or Pre-cast Gypsum Tile, the latter reinforced when carrying a roof load or retaining drainage fill.

End Walls, etc.—End walls of monitors, sawtooth skylights, "A" frames, etc., may be constructed of Gypsum Pyrobar Curb Tile (3x15x30 in. non-reinforced).

Adaptability

Although Sheetrock-Pyrofill roof construction is particularly adapted to industrial buildings and garages, it is equally adaptable to school buildings, auditoriums, gymnasiums, theaters, hospitals and hotels. Whenever steel framing is used (whether the roof be flat, pitched, monitor, sawtooth, Pond, Aiken, etc.) the inherent values of this gypsum construction may advantageously be employed. (Under certain conditions the construction may be adapted to roofs of wood framing.)

Outstanding Advantages

Fireproof—See page 1.

Light Weight—See page 2. The tables on page 4 indicate the weight of finished slabs and the amount of steel per square foot required for a total load of 45 lb. A careful comparison will show a very worthwhile saving in steel over other constructions.

High Insulation—See insulation data, page 2. In few places is insulation as important a factor as in a roof deck. Here it functions the year around—it promotes comfort and with it efficiency in summer by keeping out the heat of the sun—in winter it materially reduces heat loss. See savings in fuel and radiation given on previous page. Other authentic data on insulation savings applying to any particular installation will be furnished on application.

The Calculated Values for Various Roof Decks

Note: In the table following, the transmission is expressed in B.t.u. per hour, per square foot, per degree difference in temperature. Except as noted, all roof decks are figured with a 5-ply roof covering.

Type of Roof Deck and Covering	
2½-in. Sheetrock-Pyrofill	.35 B.t.u.'s
3-in. Sheetrock-Pyrofill	.318 B.t.u.'s
2½-in. Insulite-Pyrofill	.252 B.t.u.'s
3-in. Insulite-Pyrofill	.238 B.t.u.'s
2-in. Pine Plank	.34 B.t.u.'s
3-in. Stone Concrete	.61 B.t.u.'s
1⅝-in. Cement Tile	.68 B.t.u.'s
Corrugated Sheet Iron (no roof covering)	1.50 B.t.u.'s

Note: For heat conductivity coefficients and formula, see page 2.

Good Interior Appearance—The light color and texture of the paper-finished surface of the Sheetrock, without further finish, is neat and attractive. (The supporting subpurlins are given a shop coat to harmonize with the Sheetrock.)

Note: If the underside of the slab is to be painted or otherwise decorated, such work should not be done until the waterproof roof covering has been applied and the slab is thoroughly dry.

Economical—The simplicity of the construction tends to reduce construction costs. Sheetrock-Pyrofill will be found *very economical* on roof areas of 6,000 sq. ft. or over.

No Maintenance—The maintenance cost of Sheetrock-Pyrofill roof construction is practically nothing. Calcined gypsum is chemically inert. Examinations of steel rods and hooks, embedded for fifteen years in gypsum, have shown no evidence of progressive corrosion.

Economical Construction Suggestions

Length of Span—Usually a span of approximately 8 ft. between main purlins with a 2½-in. slab thickness will be found most economical. Note that no end bay bracing is required.

If channels are used as main purlins on sloping roofs, they should open upwards to permit proper clipping of the subpurlins with our No. 4 purlin clip.

Uniformity of Span—By preserving uniformity of span, the labor costs are reduced and standard lengths of Sheetrock may be used.

Pitch of Roof—While flat roofs require less labor than steep ones, the difference up to 30° pitch is not of sufficient importance to warrant serious consideration. On a roof, however, of 45° or over, it may be necessary to back-form from the top in order to obtain a satisfactory job and this will obviously add to the cost of the roof.

Engineering Service—Our engineering service is always accessible to assist in the greatest economy of design—see page 1.

MASTER SPECIFICATIONS—SHEETROCK-PYROFILL ROOF CONSTRUCTION

Note: Notes are explanatory or advisory only and should not be included in the specifications.

(1 Work Included

Note: Here list the various roof areas to be constructed of Sheetrock-Pyrofill and specify the prescribed live load. If live loads vary, designate the live load applying to the various areas.

(2) Supporting Structural Steel Work

All steel work for the support of the Sheetrock-Pyrofill Roof Construction has been designed not only to carry the prescribed live and dead loads, but to accommodate the most economical installation in accordance with the standard detail of the UNITED STATES GYPSUM COMPANY.

(3) Materials

(3a) General—All Gypsum products shall be as manufactured by the UNITED STATES GYPSUM COMPANY, 300 West Adams Street, Chicago, Ill.

(3b) Subpurlins—Subpurlins shall be steel *(tees) (rails)* of sizes and spacings required or indicated on the structural plans, furnished with a shop coat of paint. Provide all necessary clips *(of types best suited to conditions)* for rigidly securing subpurlins to main purlins, etc.

(3c) Sheetrock Forms—Sheetrock (⅜ in. thick x 32 in. wide) shall be mill-made to exact lengths (maximum 10 ft.) to match the main purlin centering.

Continued on next page

(3d) Reinforcement—Steel reinforcement shall be galvanized electrically-welded steel fabric made to U.S.G. specifications consisting of No. 12 main longitudinal wires 4 in. on centers and No. 14 transverse wires 8 in. on centers having a sectional area of .026 sq. in.

(3e) Pyrofill—Pyrofill shall consist of calcined gypsum and sufficient clean water for proper consistency and not to exceed 12½ lb. of clean soft wood planer shavings to every 87½ lb. of gypsum. It shall be *(mill) (field)* mixed.

(3f) Precast Curb Tile—Where so indicated on plans and details furnish 3-in. thick precast gypsum curb tile, (reinforced when carrying a roof load or retaining drainage fill). For end wall construction where so indicated furnish Pyrobar Curb Tile (3-in. x 15-in. x 30-in. non-reinforced).

(3d) Gypsum Mortar—Gypsum mortar shall consist of one part of unfibered gypsum cement plaster and not to exceed two parts of clean sharp sand.

(4) Erection

(4a) General—All Sheetrock-Pyrofill Roof Construction including all subpurlins *(curbs) (end walls) (saddles) (drainage fill)* etc., shall be completely erected by the Contracting Division of the UNITED STATES GYPSUM COMPANY.

Note: *Sheetrock-Pyrofill Roof Construction is only sold completely erected by the* UNITED STATES GYPSUM COMPANY. *For Erection Service see page 1.*

Roof construction shall be of thickness required on plans and details.

All joints in subpurlins shall be staggered or rigidly tied together. Reinforcement shall be continuous. All roof surfaces shall be screeded smooth and true ready to receive the finished waterproof roof covering.

(4b) Poured Curbs—All curbs so indicated on plans and details shall be constructed of Sheetrock-Pyrofill.

(4c) Tile Curbs—All curbs so indicated on plans and details shall be constructed of precast gypsum curb tile (reinforced when carrying roof load or retaining drainage fill) set in gypsum mortar.

(4d) End Walls, etc.—Construct all *(end walls)* of *(monitors)* *(sawtooth skylights)* *("A" frames)* *(specify)* of Pyrobar Curb Tile set in gypsum mortar.

(4e) Drainage Fill—Provide Pyrofill saddles and drainage pitches to direct roof drainage to *(gutters)* *(drainage outlets)*.

(5) Waterproof Roof Covering

Note: *Provide in the Roofing and Sheet Metal Division of the specifications that the waterproof roof covering shall be applied as soon as possible after the Sheetrock-Pyrofill slab is erected (preferably within twenty days).*

PURLIN SIZES AND WEIGHTS FOR VARIOUS TRUSS AND PURLIN SPACINGS

Based on 45 Lb. per Sq. Ft. Total Load (Live Load—30 Lb.; Slab—12 Lb.; Covering—3 lb.)

Purlin Spacing	Truss Spacing	10 ft.	12 ft.	14 ft.	16 ft.	18 ft.	20 ft.	22 ft.	24 ft.
6 ft.	Size and wt. in lb. of member	5″[-6.7	6″[-8.2	7″[-9.8	7″[-9.8	8″[-11.5	9″[-13.4	10″[-15.3	12″[-20.7
	Wt. of steel in lb. per sq. in. of roof	1.12	1.37	1.63	1.63	1.92	2.23	2.55	3.45
	Stress in purlin, lb. per sq. in.	14,290	14,070	13,750	17,850	16,970	16,090	15,300	11,430
	Total deflection, in.	.296	.349	.398	.676	.711	.739	.766	.567
7 ft.	Size and wt. in lb. of member	5″[-6.7	6″[-8.2	7″[-9.8	8″[-11.5	9″[-13.4	10″[-15.3	10″[-15.3	12″[-20.7
	Wt. of steel in lb. per sq. in. of roof	.96	1.17	1.40	1.64	1.91	2.19	2.19	2.96
	Stress in purlin, lb. per sq. in.	16,680	16,420	16,030	15,630	15,230	14,750	17,850	13,320
	Total deflection, in.	.345	.407	.464	.515	.566	.610	.894	.662
8 ft.	Size and wt. in lb. of member	6″[-8.2	7″[-9.8	7″[-9.8	8″I-11.5	9″[-13.4	10″[-15.3	12″[-20.7	12″[-20.7
	Wt. of steel in lb. per sq. in. of roof	1.03	1.23	1.23	1.44	1.68	1.91	2.59	2.59
	Stress in purlin, lb. per sq. in.	13,020	13,480	18,100	17,870	17,390	16,860	12,780	15,240
	Total deflection, in.	.225	.286	.525	.588	.646	.697	.532	.756
9 ft.	Size and wt. in lb. of member	6″[-8.2	7″[-9.8	8″[-11.5	9″[-13.4	10″[-15.3	8″I-18.4	12″[-20.7	12″[-20.7
	Wt. of steel in lb. per sq. in. of roof	.91	1.09	1.28	1.49	1.70	2.05	2.30	2.30
	Stress in purlin, lb. per sq. in.	14,650	15,150	15,380	15,430	15,380	17,840	14,380	17,130
	Total deflection, in.	.253	.322	.390	.452	.514	.923	.599	.852
10 ft.	Size and wt. in lb. of member	6″[-8.2	7″[-9.8	8″[-11.5	9″[-13.4	10″[-15.3	12″[-20.7	12″[-20.7	10″[-25.4
	Wt. of steel in lb. per sq. in. of roof	.82	.98	1.15	1.34	1.53	2.07	2.07	2.54
	Stress in purlin, lb. per sq. in.	16,280	16,850	17,100	17,160	17,070	13,220	15,980	16,650
	Total deflection, in.	.281	.358	.433	.502	.572	.454	.667	.991
11 ft.	Size and wt. in lb. of member	6″[-8.2	7″[-9.8	9″[-13.4	10″[-15.3	8″I-18.4	12″[-20.7	12″[-20.7	12″[-25.
	Wt. of steel in lb. per sq. in. of roof	.75	.89	1.22	1.39	1.67	1.88	1.88	2.27
	Stress in purlin, lb. per sq. in.	17,900	18,000	14,450	14,820	17,660	14,520	17,590	14,330
	Total deflection, in.	.309	.393	.325	.391	.740	.500	.732	.712
12 ft.	Size and wt. in lb. of member	7″[-9.8	8″[-11.5	9″[-13.4	10″[-15.3	12″[-20.7	12″[-20.7	10″[-25.4	12″[-25.
	Wt. of steel in lb. per sq. in. of roof	.82	.96	1.12	1.27	1.73	1.73	2.12	2.06
	Stress in purlin, lb. per sq. in.	14,020	15,080	15,760	16,170	12,830	15,870	16,770	15,630
	Total deflection, in.	.208	.231	.355	.426	.358	.547	.838	.777

For loads other than 45 lb. total, stresses and deflections will be directly proportionate to those shown above.

In no case is the deflection, due to live load only, greater than 1/360 of the span.

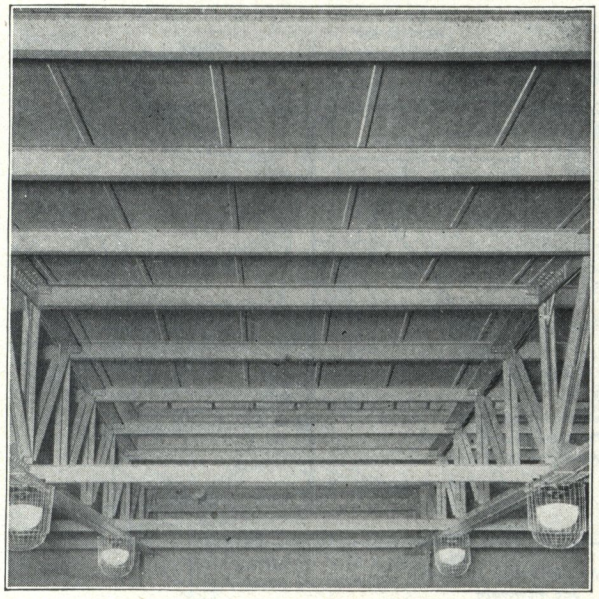
RAIL SIZES AND WEIGHTS OF SLABS

Rails spaced 32½″ — 45 Lb. per Sq. Ft. Total Load B.M. = $\frac{1}{10}$ WL; Fiber Stress, 18,000 Lb. per Sq. In.

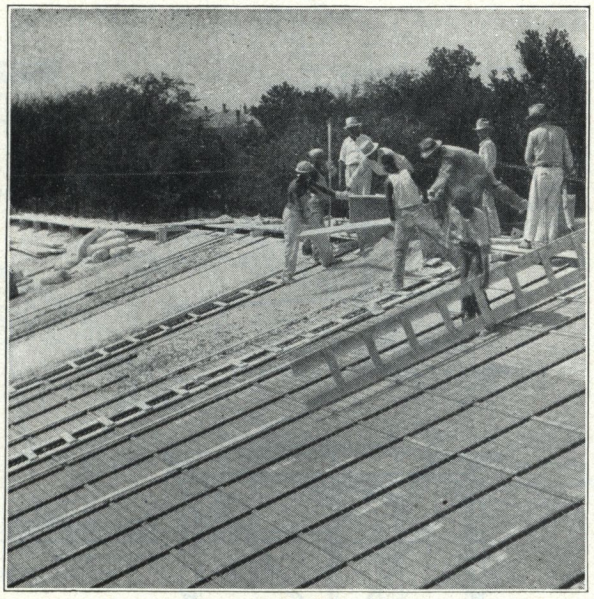
Span of main purlins	Size of rail, lb.	Weight of rail per sq. ft. of roof, lb.	*Minimum thickness of slab, in.	Weight of slab including rail, lb.
Up to 6′-4″	8	1.00	2½	11.50
6′-4″ to 8′-11″	12	1.50	2½	12.00
8′-11″ to 11′-3″	16	2.00	2½	12.50
11′-3″ to 13′-2″	20	2.50	3	15.00

*Includes thickness of Sheetrock. For other spacing of sub-purlins, or other loads, allowable span will vary inversely as the square root of the spacing or the load. Spans can be increased over those shown by considering the effect of the rail imbedment in the slab. Tests have shown that an 8-lb. rail may be used for spans up to 7 ft.

Continued on next page

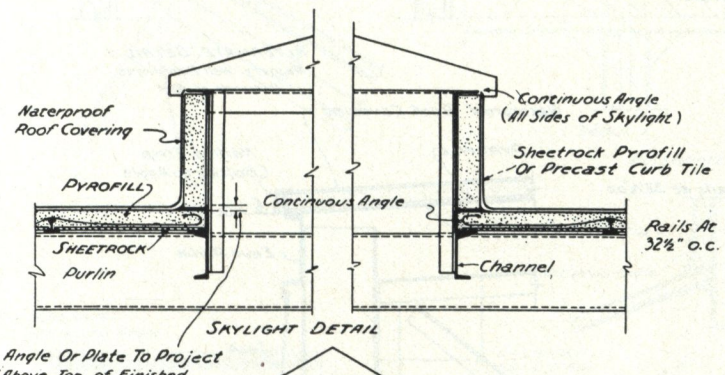


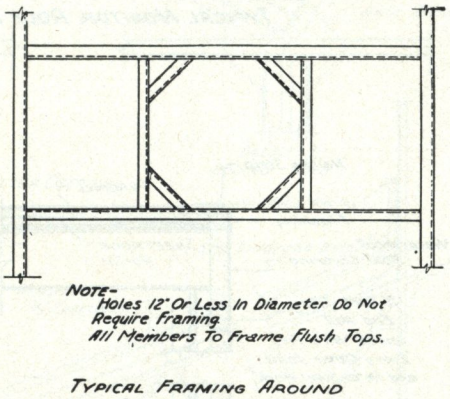
High School, LaGrange, Ill.
Jos. C. Llewellyn, Architect
Note good interior appearance

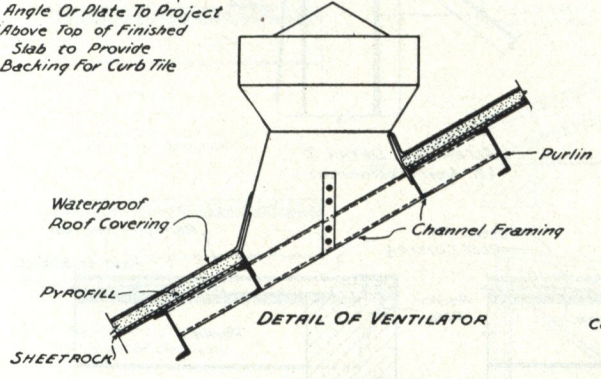


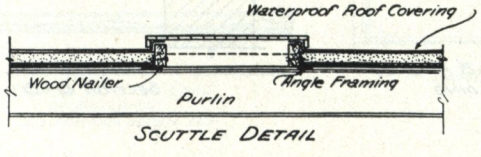
University of Texas, Austin, Tex.
Green, LaRoche & Dahl, Architects
Pouring Sheetrock-Pyrofill roof

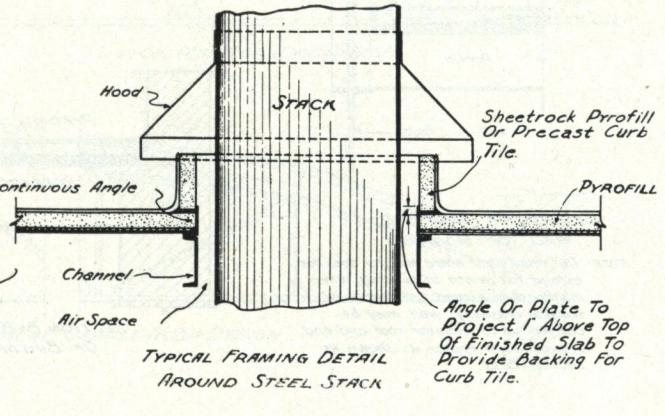
INSTALLATIONS—SHEETROCK-PYROFILL ROOF CONSTRUCTION











DETAILS—SHEETROCK-PYROFILL ROOF CONSTRUCTION

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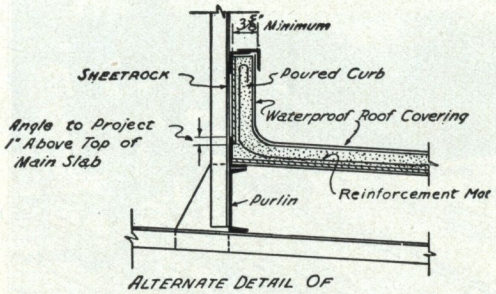
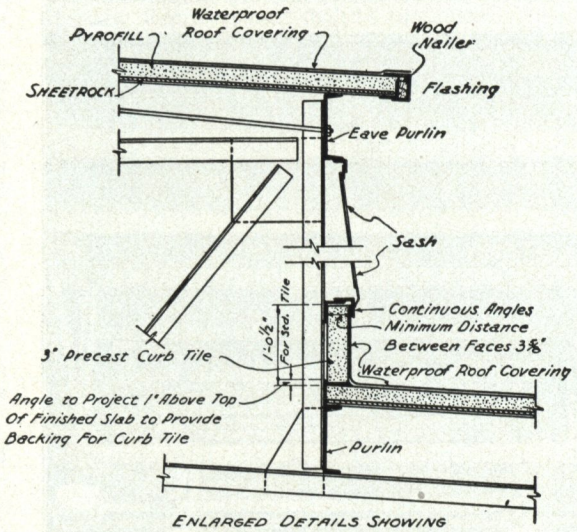
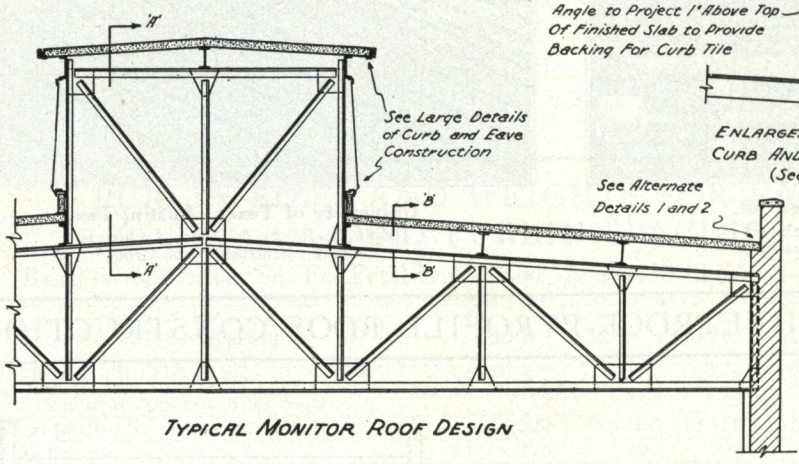


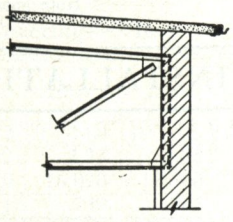
ALTERNATE DETAIL OF POURED CURB CONSTRUCTION



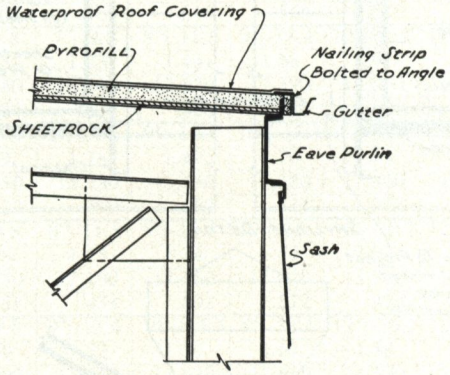
ENLARGED DETAILS SHOWING CURB AND EAVE CONSTRUCTION (See Alternate Detail)



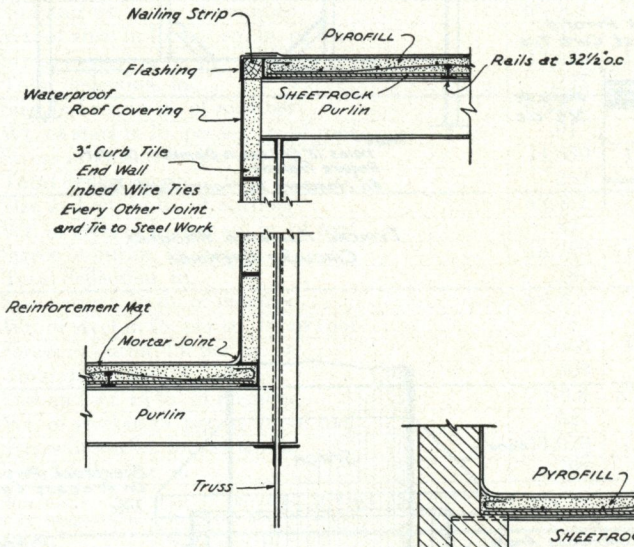
TYPICAL MONITOR ROOF DESIGN



ALTERNATE DETAIL 1
Masonry Wall Extending to Underside of Roof

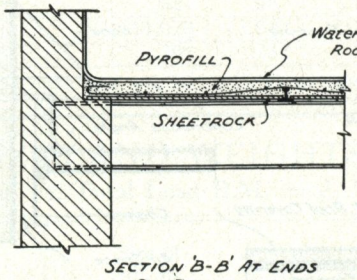


ALTERNATE DETAIL 2
(All Steel Construction)

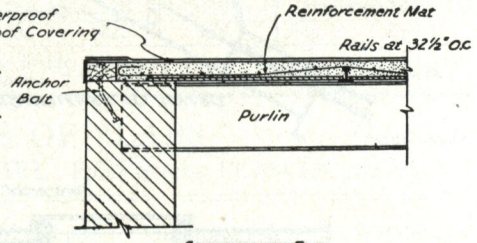


SECTION 'A A' THRU END WALL OF MONITOR

NOTE - This detail used where monitor does not extend full length of building. When monitor does extend full length of building masonry wall may be carried up to monitor roof and end section would appear as shown in section 'B-B'



SECTION 'B-B' AT ENDS OF BUILDING



ALTERNATE FOR SECTION B-B

DETAILS—SHEETROCK-PYROFILL ROOF CONSTRUCTION

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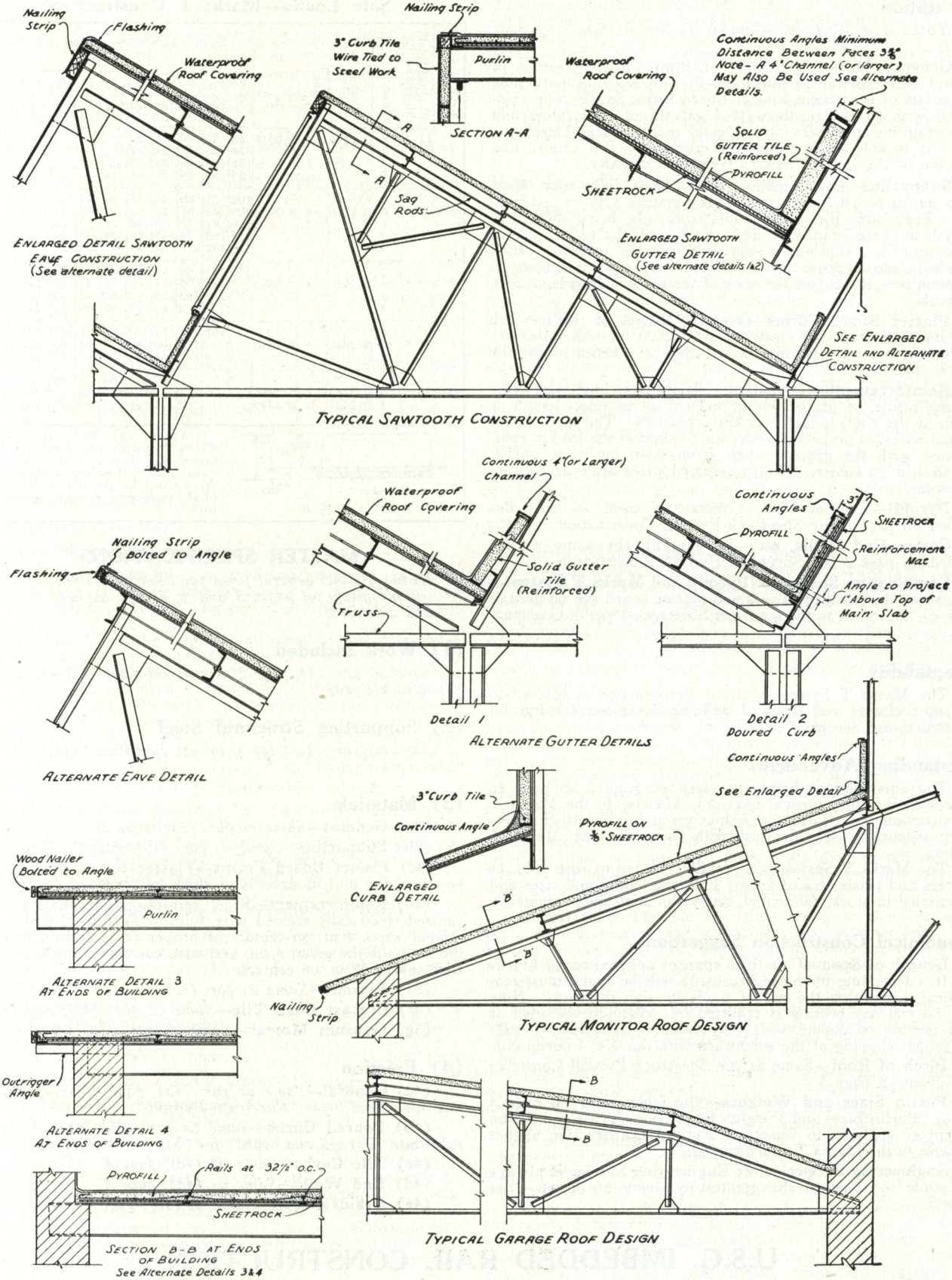


DETAILS—SHEETROCK-PYROFILL ROOF CONSTRUCTION

Continued on next page

MARKS T SYSTEM OF ROOF CONSTRUCTION

Description

Note: For "Gypsum—General Technical Data," see page 1.

General—Marks T System of Roof Construction is in general quite similar to Sheetrock-Pyrofill Roof Construction. It consists of permanent Plaster Board forms and Pyrofill reinforced with an electrically welded galvanized steel fabric and supporting steel members clipped to the main structural steel purlins. It is sold only completely erected by the Contracting Division of the UNITED STATES GYPSUM COMPANY.

Subpurlins—Large main tees or light rails span from main purlin to purlin, spaced approximately 32½ in. on centers. They carry the construction loads only, being shipped to the job in stock lengths, so as to form with the use of special U connectors, a continuous support from eave to eave. Small 1x1x⅛-in. cross tees, 2 ft. 8 in. long, are laid (not fastened) on the main tees, to support the ends of the gypsum boards, at 3 ft. intervals.

Plaster Board Forms—Over the flanges of the tees are laid standard sheets of plaster board, 32x36 in. All joints are hidden by the tees. Insulite Board may be substituted for the plaster board.

Reinforcement—Galvanized electrically welded wire reinforcing fabric, of proper width, and cut to the exact length or width of the roof, is laid over the cross tees. The main longitudinal wires, of proper cross-section to support the load in combination with the gypsum, span from main purlin to purlin, spaced 4 in. on center. The transversed wires are spaced 12 in. on center.

Pyrofill—Gypsum Fiber Concrete is used as fully described on page 3 for Sheetrock-Pyrofill Construction.

Curbs, End Walls, etc.—In general, the same as described on page 3 for Sheetrock-Pyrofill Construction.

Combination Sheetrock-Pyrofill and Marks T System—If desired, the small cross tees and plaster board can be used in place of Sheetrock in the standard Sheetrock-Pyrofill Construction.

Adaptability

The Marks T System of Roof Construction is adapted to the same classes and types of buildings as Sheetrock-Pyrofill Construction. See page 3.

Outstanding Advantages

The outstanding advantages given on page 3 applying to Sheetrock-Pyrofill Construction apply likewise to the Marks T Construction. The insulation values given for Sheetrock-Pyrofill Construction are identical with those for the Marks T System.

The Marks T System is especially adapted to rush jobs, as the tees and plaster board are of standard length and sizes and are carried in stock, fabricated, ready for immediate shipments.

Economical Construction Suggestions

Length of Span—Usually a span of approximatey 5½ to 6½ ft. (depending upon the live load) will be found most economical, permitting the use of a 2½-in. slab thickness. Note that no end bay bracing is required. If channels are used as main purlins, on sloping roofs, they should open upwards to permit proper clipping of the subpurlins with our No. 4 purlin clip.

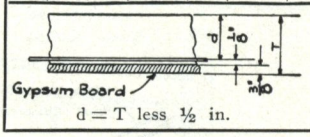
Pitch of Roof—Same as tor Sheetrock-Pyrofill Construction given on page 3.

Purlin Sizes and Weights—The table given on page 4 giving "Purlin Sizes and Weights for Various Truss and Purlin Spacings" applying to Sheetrock-Pyrofill Construction applies likewise to the Marks T Construction.

Engineering Service—Our Engineering Service is always accessible to assist in the greatest economy of design. See page 3.

Safe Loads—Marks T Construction

Thickness of slab, in. = T	Weight of slab, lb. per sq. ft.	Galvanized welded-wire reinforcement: Gauge	Diameter, in.	Spacing in.	As	Span of slab in feet (center to center of purlins): 4	4½	5	5½	6	6½	7	7½	8	8½	9
						Safe superimposed loads in pounds per sq. ft. (weight of slab has been deducted)										
2½	11.5	8	0.1620	4	0.0618	68	52	40	31	24	...	...	...	...	...	...
		7				73	56	43	34	27	...	...	...	...	...	...
		6				78	60	46	36	29	23	...	...	...	...	...
		5				83	63	49	39	31	24	...	...	...	...	...
3	13.5	8	0.1770	4	0.0738	101	77	60	48	38	30	24	...	...	...	...
		7				109	83	65	51	41	33	27	...	...	...	...
		6				116	89	70	55	44	36	29	24	...	...	...
		5				123	95	74	59	48	39	31	26	...	...	...
		4				131	101	79	63	51	42	34	28	...	...	...
3½	15.5	7	0.1920	4	0.0869	150	115	90	72	58	47	39	32	26	...	...
		6				...	123	96	77	63	51	42	35	29	24	...
		5				...	131	103	83	67	55	45	37	31	26	...
		4				...	139	110	88	72	59	49	41	34	28	...
	17.5	6	0.2070	4	0.1010	...	161	127	102	83	68	56	47	39	33	27
		5				...	...	135	109	89	73	61	51	42	36	30
		4				...	...	144	116	95	78	65	55	46	39	33
4½	19.5	5	0.2253	4	0.1196	...	...	...	137	112	93	77	65	55	46	39
		4				...	...	...	147	120	100	83	70	59	51	43
		3	0.2437		0.1399	...	...	...	157	128	107	89	75	64	55	47



d = T less ½ in.

Note: The load capacities as shown herewith are based on reinforced slab figures only. An additional factor of safety is obtained in this system by the use of the structural members in the permanent form.

MASTER SPECIFICATIONS

Note: Follow general form for Sheetrock-Pyrofill Specifications given on pages 3 and 4, except as here corrected and amended.

(1) Work Included

Same as par. (1), page 3, except substitute "Marks T" for "Sheetrock-Pyrofill."

(2) Supporting Structural Steel

Same as par. (2), page 3, except substitute "Marks T" for "Sheetrock-Pyrofill."

(3) Materials

(3a) General—*Same as par. (3a), page 3.*

(3b) Subpurlins—*Same as par. (3b), page 3.*

(3c) Plaster Board Forms—Plaster Board Forms shall be cut at the mill in sizes ⅜ in. thick by 32x36 in.

(3d) Reinforcement—Steel reinforcement shall be galvanized electrically welded wire reinforcing fabric, with longitudinal wires 4 in. on centers of proper cross section to carry the load for the given span, and with corresponding transverse wire spaced 12 in. on centers.

(3e) Pyrofill—*Same as par. (3e), page 4.*

(3f) Precast Curb Tile—*Same as par. (3f), page 4.*

(3g) Gypsum Mortar—*Same as par. (3g), page 4.*

(4) Erection

(4a) General—*Same as par. (3a), page 4, except substitute "Marks T" for "Sheetrock-Pyrofill."*

(4b) Poured Curbs—*Same as par. (3b), page 4, except substitute "Pyrofill and board" for "Sheetrock-Pyrofill."*

(4c) Tile Curbs—*Same as (4c), page 4.*

(4d) End Walls—*Same as (4d), page 4.*

(4e) Drainage Fill—*Same as (4e), page 4.*

U.S.G. IMBEDDED RAIL CONSTRUCTION

Description

This type of construction is similar to the Sheetrock-Pyrofill roof, in that standard rail subpurlins span from purlin to purlin, over which is laid the same type of reinforcing material. In order, however, to provide an all gypsum undersurface, the Sheetrock or plaster board is eliminated, and removable wooden forms are hung not less than ¾ in. below the top of the purlins, acting as a support for the slab. If desired, the beams can be formed at the same time, and fireproofed with Pyrofill. The undersurface then has the appearance of our Pyrofill Monolithic Suspension Slab, described on pages 18 to 21.

Continued on next page

PYROBAR PRECAST ROOF TILE

Description

Note: For "Gypsum—General Technical Data," see page 1.

General—All types of precast roof tiles are made of *Structolite* (see page 1) cast in steel moulds and reinforced with electrically-welded galvanized steel fabric.

Types—Pyrobar Precast Roof Tile are divided into two major groups (1) Short Span Solid and Hollow Pyrobar Roof Tile, (2) Long Span Hollow Pyrobar Roof Tile.

The Short Span Tile are subdivided into two distinct kinds, each 12 in. wide x 30 in. long, varying as follows: Standard 3-in. thick Solid Tile, weight 17 lbs. per sq. ft. 4-in. thick Hollow Tile, weight 17 lbs. per sq. ft. The tile can be notched if required for pitched roof thrust.

Where the spans are too great to permit the use of the U.S.G. Bulb Tee, we can furnish a Hooked End Roof Tile, for use with either 16-lb. or 20-lb. rails, depending upon the span and live load.

The Long Span Hollow Tile are subdivided into two thicknesses each 18 in. wide and any length from 4 to 6½ ft. (dependent on economical purlin spacing) as follows: 5 in. thick (weight 20 lb. per sq. ft.) and 6 in. thick (weight 25 lb. per sq. ft.) both thicknesses in either butt end or lap end design for I-beam or channel purlins, respectively, each notched if required for pitch roof thrust.

For details of each type and their variations, see page 13.

Outstanding Advantages

Fireproof—See page 1.

Light Weight—See page 2.

Structural Strength—The structural strength of Pyrobar Roof Tile is amply demonstrated by actual use of the product in the field over a long period as well as by authoritative tests.

An example of the latter is afforded by the transverse bending tests made on Short Span Tile at Columbia University in 1922. In these tests the load was applied at the third points until failure was produced. For the 3 x 12 x 30-in. Solid Short Span Pyrobar Tile, the total load applied at the third point averaged 1020 lb. This represents an equivalent uniformly distributed load of 545 lb. per sq. ft. From the above it is seen that the factor of safety afforded by Pyrobar Roof Tile is more than sufficient for the purpose.

Complete test data will be furnished on request.

High Insulation—See page 12. One of the determining factors in the introduction of Pyrobar Roof Tile more than fifteen years ago was its high insulation value effectively *reducing condensation* and *saving fuel.* Authentic data on insulation savings will be furnished on application.

The Calculated Values for Various Roof Decks

Note: In the table following, the transmission is expressed in B.t.u. per hour per square foot per degree difference in temperature. All roof decks are figured with 5-ply roof covering.

3-in. Solid Short Span Pyrobar	.41 B.t.u.'s
4-in. Hollow Short Span Pyrobar	.35 B.t.u.'s
5-in. Long Span Hollow Pyrobar	.30 B.t.u.'s
6-in. Long Span Hollow Pyrobar	.26 B.t.u.'s

Not Attacked by Sulphur Gases—See page 2.

Good Interior Appearance—The interior appearance is neat and the surface an excellent light reflector.

Economical—Pyrobar Roof Tile are low in cost and permanent. The large lightweight units are easily and speedily erected in any kind of weather in which it is possible to work. The tile are laid directly on the supporting steel work and require only the grouting of joints to make the roof ready for the waterproof covering. This can follow immediately, materially shortening the construction period and making possible earlier occupancy. Maintenance cost is practically nothing.

Broad Adaptability

There is a type of Pyrobar Roof Tile to meet every requirement. The various types and spans are adapted to all kinds of steel framework as they are easily cut to fit around skylights, ventilators, stacks, etc. They are also suited to meet the hip and valley construction of steep pitched roofs, curved surfaces and intricate roof designs and to take slate, tile and metal roof covering. Coupled with the insulating qualities its resistance to sulphur dioxide fumes makes Pyrobar Roof Tile the logical choice for railroad as well as any industrial buildings where this condition must be given first consideration.

The particular adaptability of each type of tile is given in detail below and on next page.

Short Span Pyrobar Roof Tile

Note: For sizes and varieties see "Types" under "Description" in opposite column above. For details see page 13. For curbs, walls, drainage fill, etc., see page 10.

Adaptability—The 3-in. Solid is recommended particularly for nailing purposes because it assures maximum penetration and thus the greatest nail-holding ability. The 4-in. Hollow fills all requirements for a light weight tile to be covered with a built-up roof covering. It is not recommended for nailing purposes. Both tile give a flat ceiling. The short span tile construction is by far the most flexible of any precast system. It can be used with economy on any type of factory or industrial building, power plant, school, etc., and in addition is particularly well adapted to steep pitched roofs or roofs that are badly cut up with dormers, hips, valleys and difficult intersections.

Reinforcement—Reinforcement consists of an electrically welded galvanized steel mat, with five No. 12 longitudinal wires and No. 14 cross wires, 4 in. on centers. See details, page 13.

Purlin Requirements—Short Span (30 in. long) Roof Tile, require subpurlin supports. These are usually Tees (such as U.S.G. Bulb Tees) but light I-beams or channels may be used with economy on spans up to 12 ft. The most economical span for the U.S.G. Bulb Tee is 7 ft., 4 in. A notched 3-in. solid x 30-in. long tile laid directly on light I-beam purlins which span directly between steel trusses or main supports has proven economical in many cases. Note that no end bay bracing is required.

Special U.S.G. Bulb Tee Subpurlins—This section has been developed primarily for use with Short Span Pyrobar Roof Tile, as a more economical subpurlin than standard tees. The wide flange provides ample bearing for the tile, and being designed particularly for this purpose, it has considerably less sectional area than a standard tee of equal load bearing capacity. The United States Gypsum Company is prepared to furnish the bulb tees, erected in place in connection with its installation of Short Span Pyrobar Roof Tile, or, if desired in connection with your own installation of Pyrobar the bulb tee can be furnished fabricated for erection with the structural steel. See details page 13.

Installation—The tile are laid directly on the steel supports without mortar and with sides tight together with full bearing on the subpurlin. The grouting joints are then filled with gypsum mortar and the roof is immediately ready for the application of the roof covering.

Ornamental Roof Covering—A successful application of ornamental roof covering depends upon density of the slab (3-in. Solid tile is recommended) type and penetration of nail, type of covering and slope of the roof. The roof deck should be thoroughly dry or as nearly so as can be reasonably obtained. Square cut hard copper or brass nails have proven their superiority after a large number of tests on all types.

Application of ordinary slate or ornamental tile to roofs up to 60° slope should be made with nails having not less than 2 in. penetration. When the slope is greater than 60° or extra heavy slate or tile is to be fastened, the problem requires special study with any type of nailing deck.

Application of sheet metal (tin or copper) requires thoroughly rigid fastening due to the strain put upon the cleat nails by the expansion and contraction of the sheets. Particularly, there should be sufficient cleats to securely anchor the sheets to the roof construction. Standard practice indicates that the spacing of cleats should be approximately 8 in. on centers, each secured with two nails having not less than 2-in. penetration as mentioned above.

It is standard practice to use a sheet of roofing felt between the gypsum roof deck and the ornamental covering, whether of slate, tile or metal.

Continued on next page

Long Span Hollow Roof Tile

Note: For sizes and varieties see "Types" under "Description," page 9. For details see page 13. For curbs, walls, drainage fill, etc., see below.

Adaptability—Long Span Hollow Pyrobar Roof Tile are primarily designed to provide a flat uniform ceiling with maximum light reflection and insulation. They are manufactured in lengths 4 ft. to 6 ft. 6 in. to suit the steel framing and in depths of 5 and 6 in. The 6-in. depth affords maximum insulation and strength. The tile can be notched to fit over the purlin flanges if desired, and can be furnished either with or without lap joint, depending on the bearing afforded. Lap joint should be used whenever channel purlins are provided. Long Span Tile are not recommended for roofs with difficult framing requiring considerable cutting, nor where a nailing deck is required.

Reinforcement—Consists of an electrically-welded, galvanized steel mat, properly designed to support the load, as shown on details, page 13.

Purlin Requirements—The tile are made to span from purlin to purlin (either steel or wood)—no tees or other type of subpurlins are required. The most economical purlin spacing is approximately 6 ft. Spacing may vary from 4 ft. to not to exceed 6½ ft.

Installations—The tile are laid directly on the steel subpurlins or wood framing with sides tight together. The grouting joints on the top surface are then filled with gypsum mortar and the roof is immediately ready for the application of the roof covering. See tables, page 11.

Gutter and Curb Tile, Drainage Fill

Gutter Tile—Sawtooth valleys, curbs under sawtooth sash, etc., restraining drainage fill or subject to roof loads, are constructed of 3-in. solid reinforced Pyrobar Gutter Tile, 12 in. wide and made in lengths to fit the steel work.

Curb Tile—Curbs, above and below monitor and sawtooth sash, end walls, etc., which do not sustain a superimposed roof load or restrain drainage fill are constructed of 3-in. solid non-reinforced Pyrobar Curb Tile, 15x30 in.

Drainage Fill—The use of Pyrofill (see page 3) for drainage fill over Pyrobar roofs, is ideal on account of its light weight and the quick setting qualities of gypsum. Where deep fill is required the Pyrofill is laid over dry cinders tamped in place. The Pyrofill provides a smooth surface for the roof covering and is an excellent material for constructing fillets and leveling off uneven and broken surfaces, in connection with difficult roof framing.

Re-roofing

All types of Pyrobar Roof Tile, particularly the Short Span Tile, provide a solution of the re-roofing problem. The desired area on the old roof can be removed and replaced immediately with Pyrobar, without interrupting the activities below.

In connection with re-roofing work, the United States Gypsum Company through its Contracting Division will remove the old roof deck or covering, furnish and place additional steel if required, and erect the new Pyrobar Roof Deck, ready for the roof covering. Our wide experience in this field is at your service.

Economical Construction Suggestions

The Proper Steelwork Design—The proper design and detail of the steelwork to best accommodate the roof tile cannot be too strongly emphasized. Sufficient bearing for the tile is very essential. A channel or double angles are usually required at the upper edge of the curb tile to form a sill for sash and also to hold the tile in place. If the curb tile is on a slope or sustains a superimposed load such as drainage fill, an angle should be used at the lower edge. Stop angles to prevent sliding of roof tile on a steep pitch are necessary.

On sloping roofs, if channels are used for main purlins, they should open upwards in order to permit proper clipping of the subpurlins. See details, page 11.

We recommend the use of tie rods for all roofs using channel purlins regardless of the slope or pitch.

Curb tile under sash, skylight frames, etc., are made in a standard size of 3x15x30 in. and the designer should arrange the steel work to accommodate either the full 15 or 30-in. dimension.

Note: If the above is impossible, these tile can be furnished in 15-in. widths with lengths to fit the steel.

On page 13 will be found details and weights of the various types of precast roof tile. On page 11 are tables giving the size, stress, deflection and square foot weight of purlins under various conditions of truss spacing and tile lengths.

The use of these data together with the construction details given on pages 14, 15, 16 and 17 will be of assistance to the designer.

By following standard practice and conforming to the manufacturer's details and specifications, special sizes of tile and difficult conditions will be reduced to a minimum and economy will naturally follow.

Openings—Openings larger than 12 in. must be provided with suitable framing. The tile are readily cut to fit around openings of any size.

This applies particularly to openings for ventilators. Construction details on page 16 show methods of attaching ventilators to precast and poured roof construction. Where ventilators are installed after the roof has been constructed, the details should be referred to our Engineering Department.

Lap Joint Tile—For Long Span Tile, when channel purlins are used, lap joint tile must be used. See details page 58.

Notched Tile—Our standard practice permits notching Short Span Tile and Long Span Hollow Tile to eliminate thrust on pitched roofs. See details, page 13.

Engineering Service—Our engineering service is always accessible to assist in the greatest economy of design—see page 1.

MASTER SPECIFICATIONS—PYROBAR PRECAST ROOF TILE

Note: Notes are explanatory or advisory only and should not be included in the specifications.

(1) Work Included

Note: Here list the various roof areas to be constructed of Pyrobar Precast Roof Tile and specify the prescribed live load. If more than one type of tile is used list separately the areas constructed of each.

(2) Supporting Structural Steel Work

All steel work for the support of the Pyrobar Precast Roof Tile Construction has been designed not only to carry the prescribed live and dead loads, but to accommodate the most economical standard tile installation in accordance with the standard details of the United States Gypsum Company.

Note: See particularly "Purlin Requirements" and "Special U.S.G. Bulb Tee Subpurlins" under heading "Short Span Pyrobar Roof Tile," page 9; "Purlin Requirements" under heading "Long Span Hollow Roof Tile," above, and heading "Economical Construction Suggestions," above.

(3) Materials

(3a) General—All Gypsum products shall be as manufactured by the United States Gypsum Company, 300 West Adams Street, Chicago, Ill.

(3b) Short Span Tile—Where so designated the roof slab shall be constructed of Pyrobar Short Span *(Solid) (Hollow) (Notched End)* Roof Tile.

Note: See "Types" under heading "Description," also "Short Span Pyrobar Roof Tile" on page 9.

(3c) Special U.S.G. Bulb Tee Subpurlins—All subpurlins shall be special U.S.G. Bulb Tees.

Continued on next page

(3d) Long Span Hollow Tile—Where so designated the roof slab shall be constructed of Pyrobar Long Span Hollow *(lap end) (notched end)* Roof Tile of thickness indicated.

Note: *See "Types" under heading "Description," page 9, and "Long Span Hollow Roof Tile," page 10.*

(3e) Precast Gutter and Curb Tile—Where so indicated on plans and details furnish reinforced Gypsum Gutter Tile (3x12 in. by lengths as required) to restrain drainage fill or carry roof loads. Furnish also all necessary non-reinforced Gypsum Curb Tile (3x15x30 in.) for curbs, walls, etc., which do not carry roof loads or restrain drainage fill.

Note: *See "Gutter and Curb Tile," page 10.*

(3f) Gypsum Mortar—Gypsum mortar shall consist of one part of unfibered gypsum cement plaster and not to exceed two parts of clean, sharp sand.

(3g) Pyrofill—Pyrofill (Gypsum Fiber Concrete) shall consist of calcined gypsum and sufficient clean water for proper consistency and not to exceed 12½ lbs. of clean soft wood planer shavings to 87½ lbs. of gypsum.

Note: *See "Drainage Fill," page 10.*

(4) Erection

(4a) By United States Gypsum Company—All Pyrobar Precast Roof Tile Construction, including all *(U.S.G. bulb tee subpurlins) (curbs) (end walls) (saddles) (drainage fill),* etc., shall be completely erected by the Contracting Division of the UNITED STATES GYPSUM COMPANY.

Note: *For Erection Service see page 1.*

(4b) General—All Pyrobar Precast Roof Tile shall be accurately laid, without mortar, upon the supporting steel work. Bearings shall be even and full and the tile units laid tight. All joints on top surface shall be pointed full with gypsum mortar, struck smooth. All roof surfaces shall be left smooth and true ready to receive the finished waterproof roof covering.

(4c) Tile Curbs—All curbs so indicated on plans and details shall be built of Precast Curb Tile (reinforced when restraining drainage fill or carrying roof loads). Tile shall be laid in gypsum mortar.

(4d) End Walls, etc.—Where so indicated on plans and details, construct all *(end)* walls of *(monitors) (sawtooth skylights) ("A" frames)* etc. of Pyrobar Curb Tile set in gypsum mortar.

(4e) Saddles and Drainage Fill—Provide Pyrofill saddles and drainage pitches to direct roof drainage to *(gutters) (drainage outlets).* Where deep fill is required, build the fill of clean dry cinders throughly tamped, finished with a surface of Pyrofill.

(5) Waterproof Roof Covering

Note: *Provide in the Roofing and Sheet Metal division of the specifications that the waterproof roof covering shall be applied as soon as possible after the gypsum roof slab is erected (preferably within twenty days).*

Note: *For application of ornamental roofing, such as slate, tile and metal see recommendations given in "Ornamental Roof Covering" under heading "Short Span Roof Tile," page 9.*

PURLIN SIZES AND WEIGHTS FOR VARIOUS TRUSS AND PURLIN SPACINGS

Based on 50 Lb. per Sq. Ft. Total Load—(Live Load—30 Lb.; Slab—17 Lb.; Covering—3 Lb.)

Note: Long Span Tile is not furnished for spans over 6 ft. 6 in.

Purlin Spacing	Truss spacing	8 ft.	10 ft.	12 ft.	14 ft.	16 ft.	18 ft.	20 ft.	22 ft.	24 ft.
4 ft.	Size and wt. in lb. of member	4″[-5.4	4″[-5.4	5″[-6.7	6″[-8.2	7″[-9.8	7″[-9.8	8″[-11.5	9″[-13.4	9″[-13.4
	Wt. of steel in lb. per sq. in. of roof	1.35	1.35	1.67	2.05	2.45	2.45	2.88	3.35	3.35
	Stress in purlin, lb. per sq. in.	10,510	16,420	15,180	14,100	13,230	16,750	15,430	14,350	17,080
	Total deflection, in.	.174	.424	.452	.476	.502	.802	.799	.798	1.131
5 ft.	Size and wt. in lb. of member	4″[-5.4	5″[-6.7	6″[-8.2	6″[-8.2	7″[-9.8	8″[-11.5	9″[-13.4	9″[-13.4	10″[-15.3
	Wt. of steel in lb. per sq. in. of roof	1.08	1.34	1.64	1.64	1.96	2.30	2.68	2.68	3.06
	Stress in purlin, lb. per sq. in.	13,120	13,180	12,980	17,630	16,550	15,610	14,820	17,950	16,780
	Total deflection, in.	.217	.273	.322	.595	.627	.653	.683	.998	.999
6 ft.	Size and wt. in lb. of member	4″[-5.4	5″[-6.7	6″[-8.2	7″[-9.8	8″[-11.5	9″[-13.4	9″[-13.4	10″[-15.3	12″[-20.7
	Wt. of steel in lb. per sq. in. of roof	.90	1.12	1.37	1.63	1.92	2.23	2.23	2.55	3.45
	Stress in purlin, lb. per sq. in.	15,750	15,800	15,550	15,170	14,830	14,380	17,780	16,890	12,630
	Total deflection, in.	.262	.327	.386	.441	.491	.535	.820	.847	.627
6 ft. 6 in.	Size and wt. in lb. of member	4″[-5.4	5″[-6.7	6″[-8.2	7″[-9.8	8″[-11.5	9″[-13.4	10″[-15.3	8″I-18.4	12″[-20.7
	Wt. of steel in lb. per sq. in. of roof	.83	1.03	1.26	1.51	1.77	2.06	2.35	2.83	3.19
	Stress in purlin, lb. per sq. in.	17,080	17,120	16,850	16,430	15,980	15,570	15,120	17,340	13,680
	Total deflection, in.	.282	.354	.418	.477	.532	.579	.627	1.078	.678
7 ft.	Size and wt. in lb. of member	4″[-5.4	5″[-6.7	6″[-8.2	7″[-9.8	8″[-11.5	9″[-13.4	10″[-15.3	12″[-20.7	12″[-20.7
	Wt. of steel in lb. per sq. in. of roof	.77	.96	1.17	1.40	1.64	1.91	2.19	2.96	2.96
	Stress in purlin, lb. per sq. in.	18,000	18,000	17,850	17,700	17,200	16,780	16,290	12,430	14,730
	Total deflection, in.	.304	.375	.450	.513	.572	.624	.677	.516	.731
8 ft.	Size and wt. in lb. of member	.....	6″[-8.2	7″[-9.8	8″[-11.5	9″[-13.4	10″[-15.3	8″I-18.4	12″[-20.7	12″[-20.7
	Wt. of steel in lb. per sq. in. of roof	.....	1.02	1.23	1.44	1.68	1.91	2.30	2.59	2.59
	Stress in purlin, lb. per sq. in.	.....	14,400	14,920	15,110	15,120	15,080	17,570	14,220	16,830
	Total deflection, in.	.....	.249	.317	.383	.447	.504	.906	.588	.836

For loads other than 50-lb. total, stresses and deflections will be directly proportionate to those shown above. Thus a lighter load or consideration of only live load deflection will permit the use of a considerably lighter section. In no case is the deflection, due to live load only, greater than 1/360 of the span.

SUBPURLIN SIZES FOR PURLIN SPANS UP TO 8 FT. 5 IN.

Used with Short Span Tile, Solid and Hollow—18,000-lb. Stress

Spaced 30¾ in. on Centers — 50 lb. per Sq. Ft. Total Load — BM = $\frac{1}{10}$ WL

Span	6′ 1″	6′ 11″	7′ 9″	8′ 5″
Size of tee	2¼x2¼—4.1 lb.	2¼x2¼—4.9 lb.	2½x2½—5.5 lb.	2½x2½—6.4 lb.

U.S.G. Bulb Tee—3.1 Lb.—1.25 lb. Steel per sq. ft. of roof—Span to 7′-4″

For other spacing of subpurlins, or other loads, allowable span will vary inversely as the square root of the spacing or the load.

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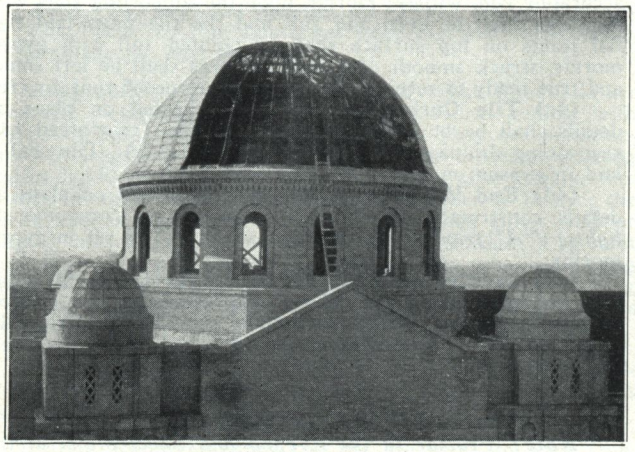
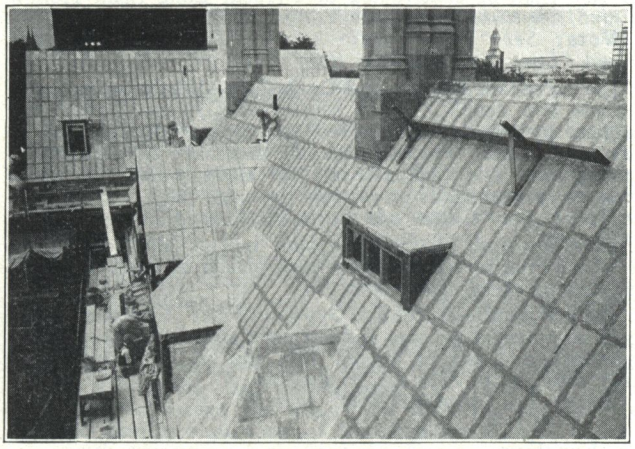
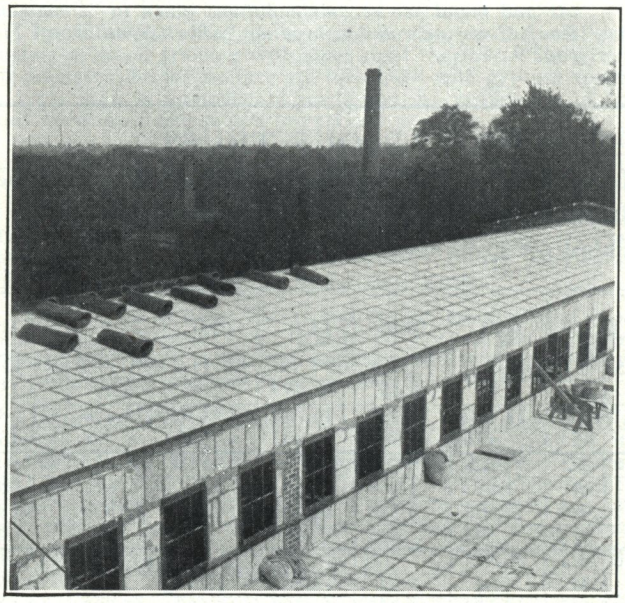


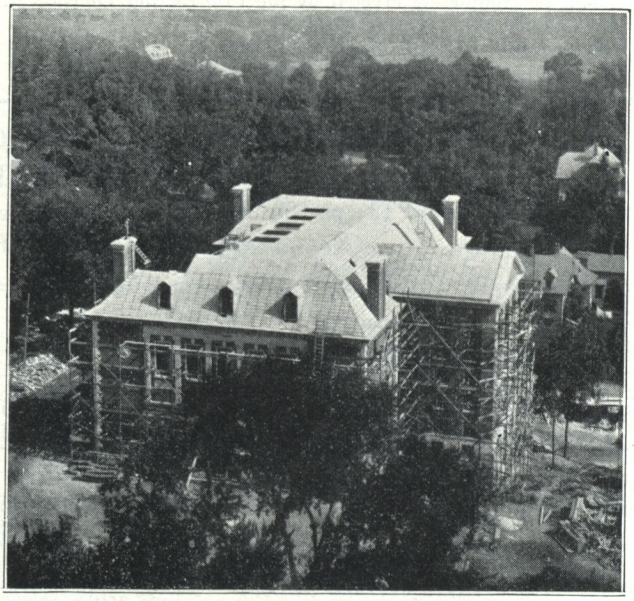
St. Casimir's Church, Buffalo, N. Y.
OAKLEY & SHALLMO, Architects
6400 sq. ft. Short Span Pyrobar



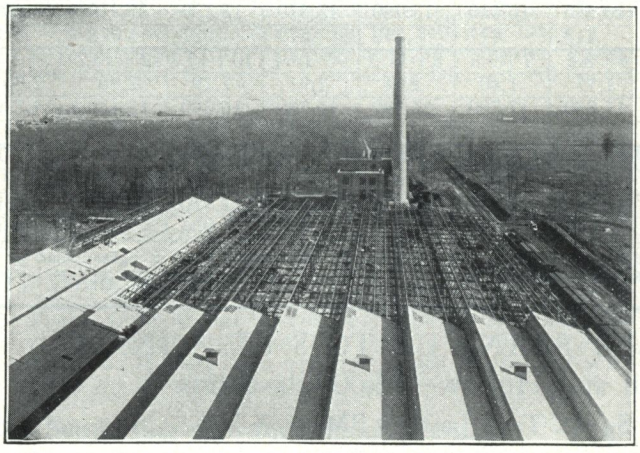
Bingham Hall, Yale University, New Haven, Conn.
W. B. CHAMBERS, Architect
11,755 sq. ft. Short Span Pyrobar

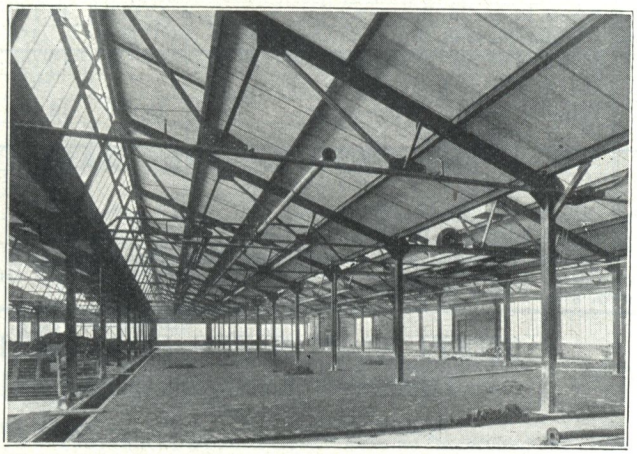


Incinerator Plant, City of Baltimore, Md.
Note the Pyrobar Curb and Monitor Wall Construction



Williams College Library, Williamstown, Mass.
CRAM & FERGUSON, Architects
14,000 sq. ft. Short Span Pyrobar





Tractor Plant, International Harvester Co., Fort Wayne, Ind
DAY AND ZIMMERMAN, Architects
300,000 sq. ft. Long Span Hollow Pyrobar

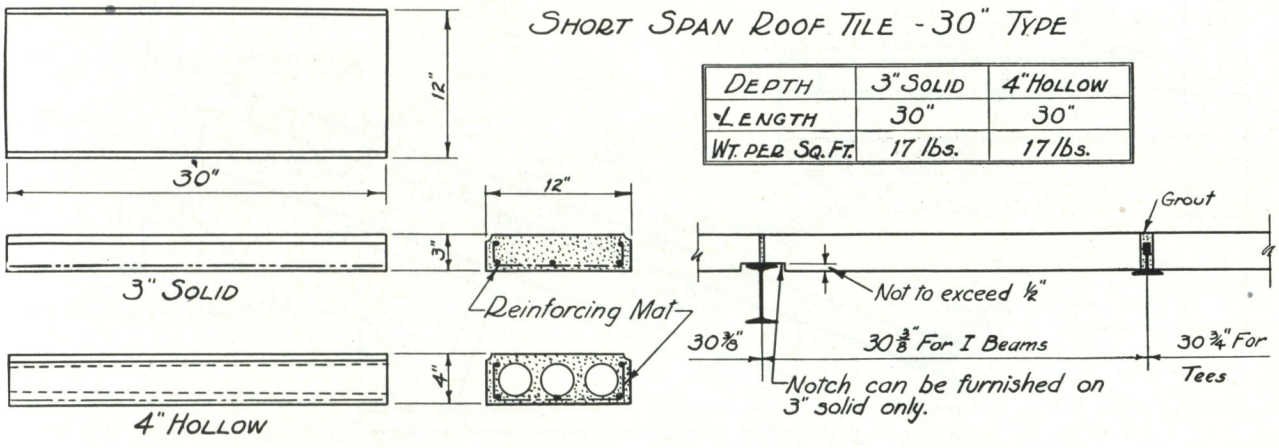
TYPICAL INSTALLATIONS—PYROBAR ROOF TILE

Continued on next page

DETAILS OF PYROBAR ROOF TILE

NOTE: ALL TILE REINFORCED WITH ELECTRICALLY WELDED GALVANIZED STEEL MAT

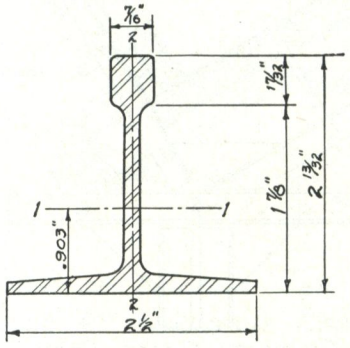
SHORT SPAN ROOF TILE - 30" TYPE



DEPTH	3" SOLID	4" HOLLOW
LENGTH	30"	30"
WT. PER SQ. FT.	17 lbs.	17 lbs.

U. S. G. BULB TEE SUB-PURLIN (STEEL)

FOR SHORT SPAN ROOF TILE



WEIGHT PER YARD	9.30 LBS.
AREA OF SECTION	.890 IN^2
SECTION MODULUS-AXIS 1-1	.462 IN^3
MOMENT OF INERTIA-AXIS 1-1	.695 IN^4
SECTION MODULUS-AXIS 2-2	.150 IN^3
MOMENT OF INERTIA-AXIS 2-2	.188 IN^4

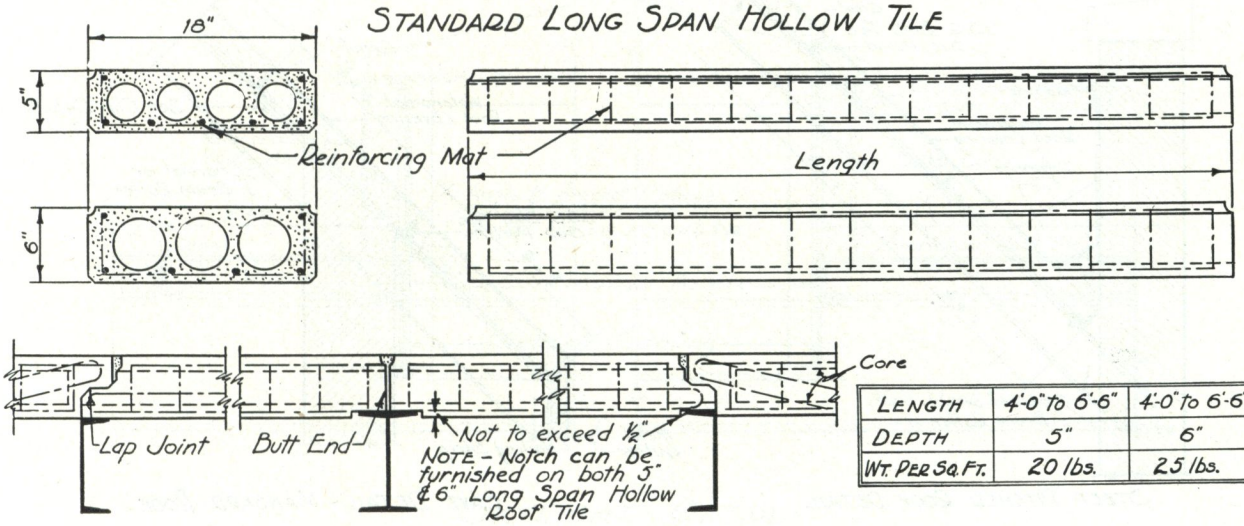
Allowable Spans based on Total Load of 50 lbs. per square foot, spacing of 2'-6¾" - Steel stress of 18,000 lbs. per sq. in. - See note below.

MAX. SPAN 7'-4" } WL/10
MAX. DEFLECTION .27" }

MAX. SPAN 6'-8" } WL/8
MAX. DEFLECTION .23" }

NOTE:-
For spacing other than 2'-6¾", or load other than 50 lbs., the allowable span will vary inversely as the square root of the spacing or the load.

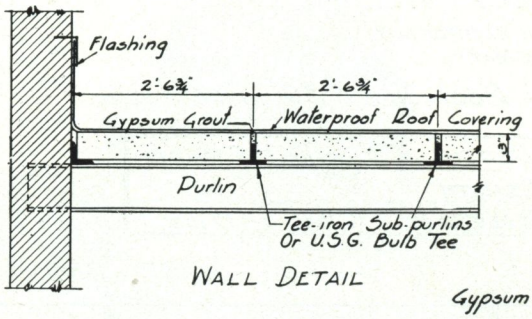
STANDARD LONG SPAN HOLLOW TILE



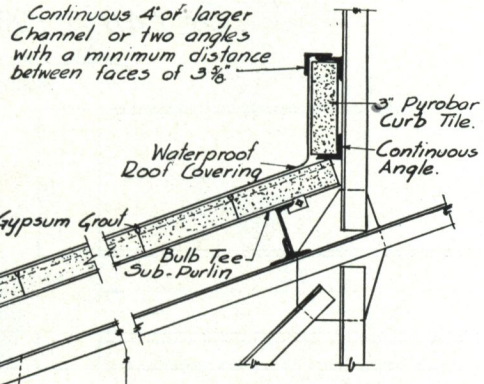
LENGTH	4'-0" to 6'-6"	4'-0" to 6'-6"
DEPTH	5"	6"
WT. PER SQ. FT.	20 lbs.	25 lbs.

DETAILS OF PYROBAR PRECAST ROOF TILE

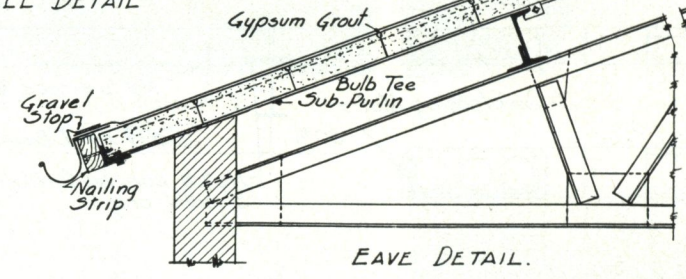
Continued on next page



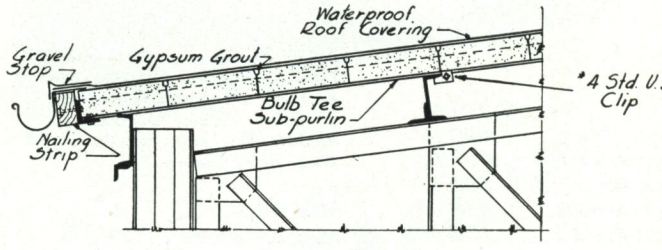
WALL DETAIL



MONITOR CURB DETAIL



EAVE DETAIL.



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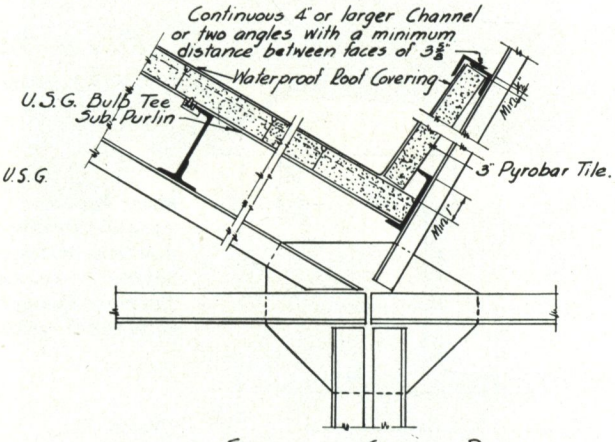
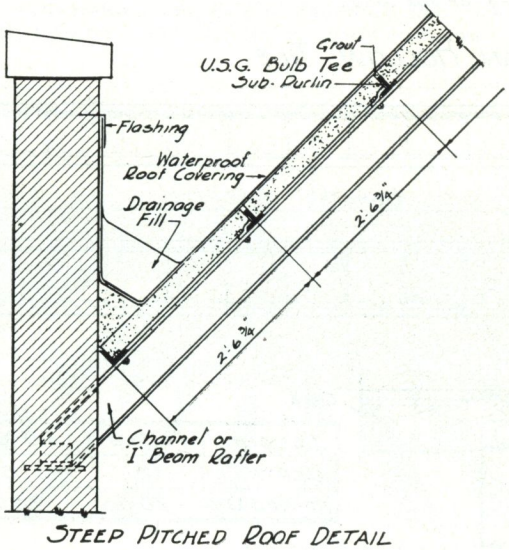
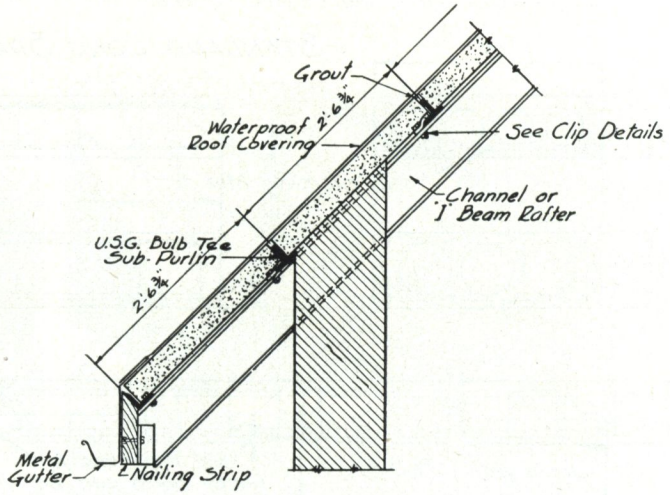


SAWTOOTH GUTTER DETAIL



STEEP PITCHED ROOF DETAIL

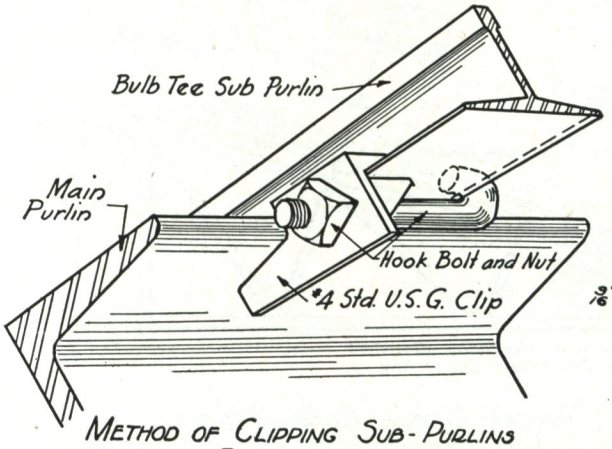


EAVE DETAIL - MANSARD ROOF

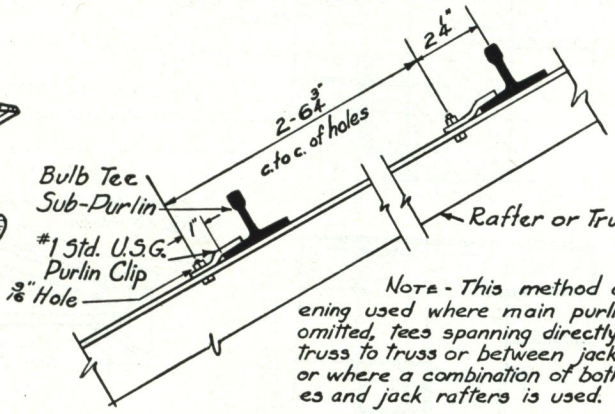
DETAILS OF SHORT SPAN PYROBAR ROOF TILE

Continued on next page

DETAILS OF TEES & SHORT SPAN (30" TYPE) ROOF TILE

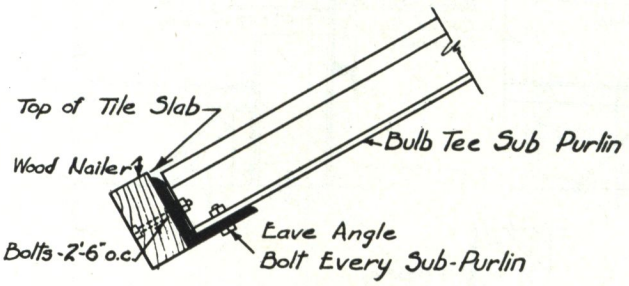


METHOD OF CLIPPING SUB-PURLINS TO MAIN PURLINS - SLOPED ROOF

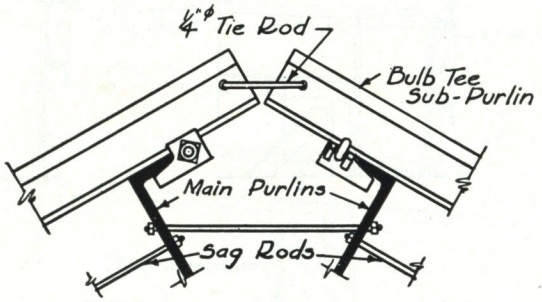


NOTE - This method of fastening used where main purlins are omitted, tees spanning directly from truss to truss or between jack rafters or where a combination of both trusses and jack rafters is used.

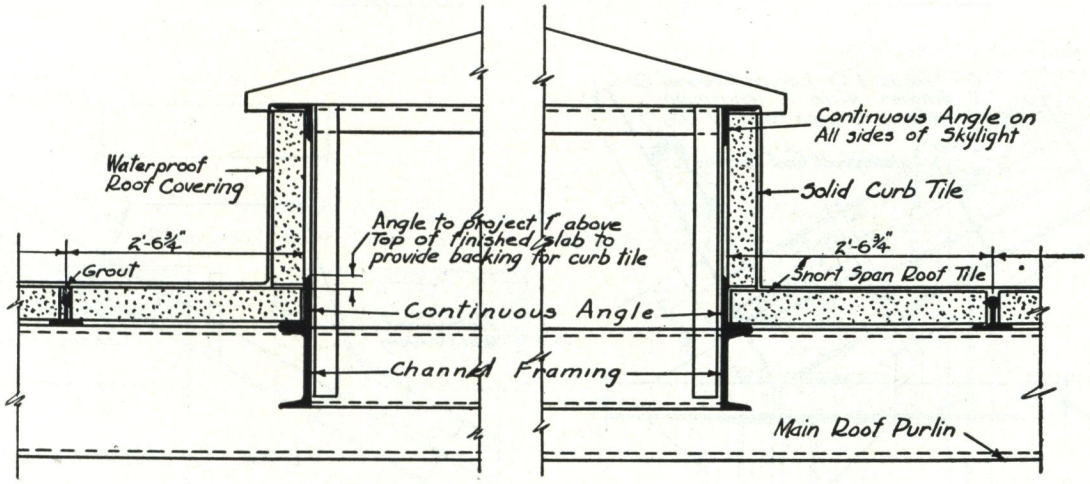
METHOD OF CLIPPING SUB-PURLINS TO TRUSSES OR JACK RAFTERS



METHOD OF BOLTING TEE TO ANGLE AT OVERHANG EAVES



RIDGE DETAIL



SKYLIGHT DETAIL

DETAILS OF SHORT SPAN PYROBAR ROOF TILE

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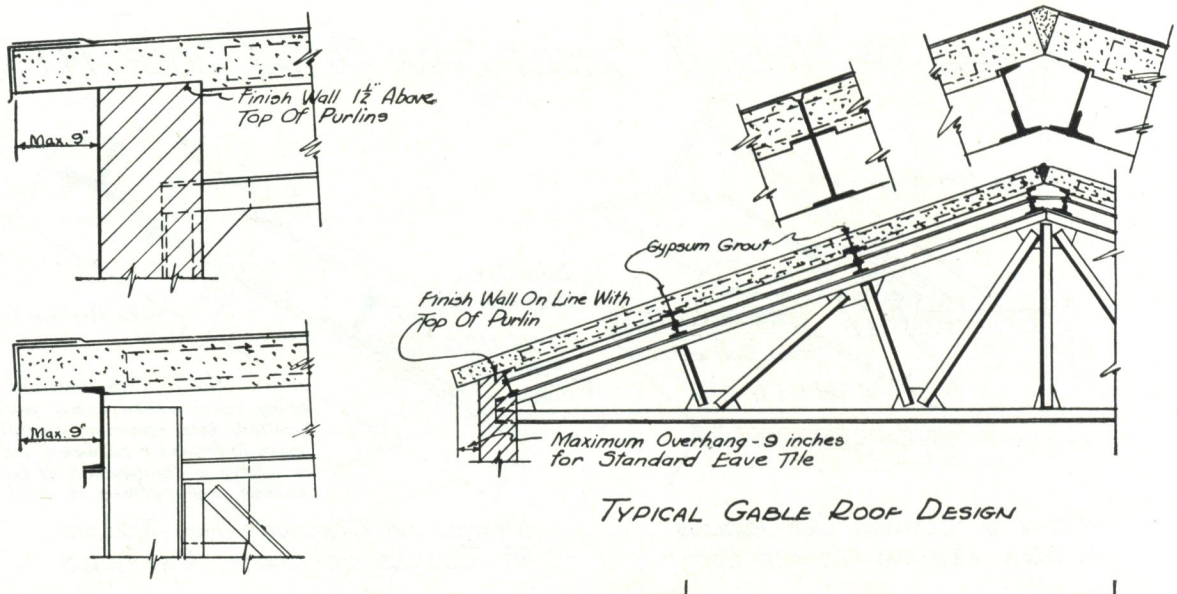
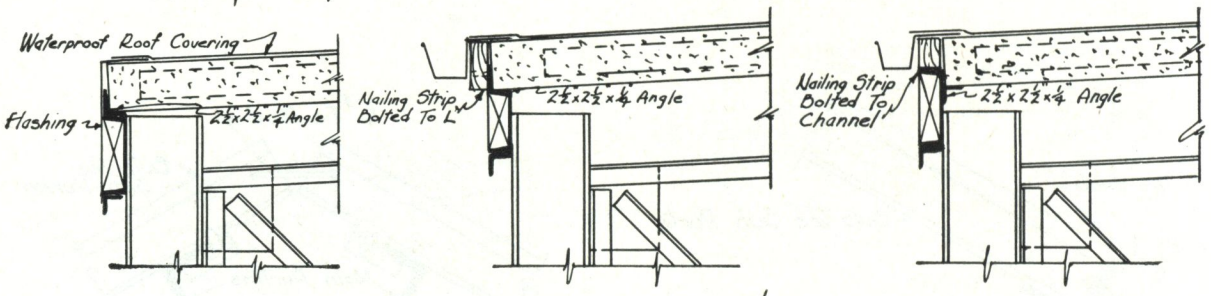
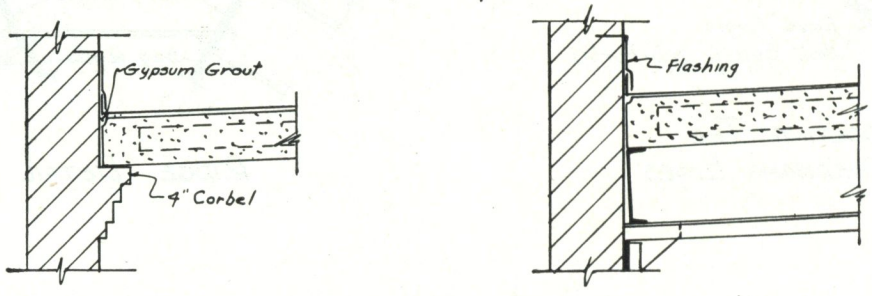
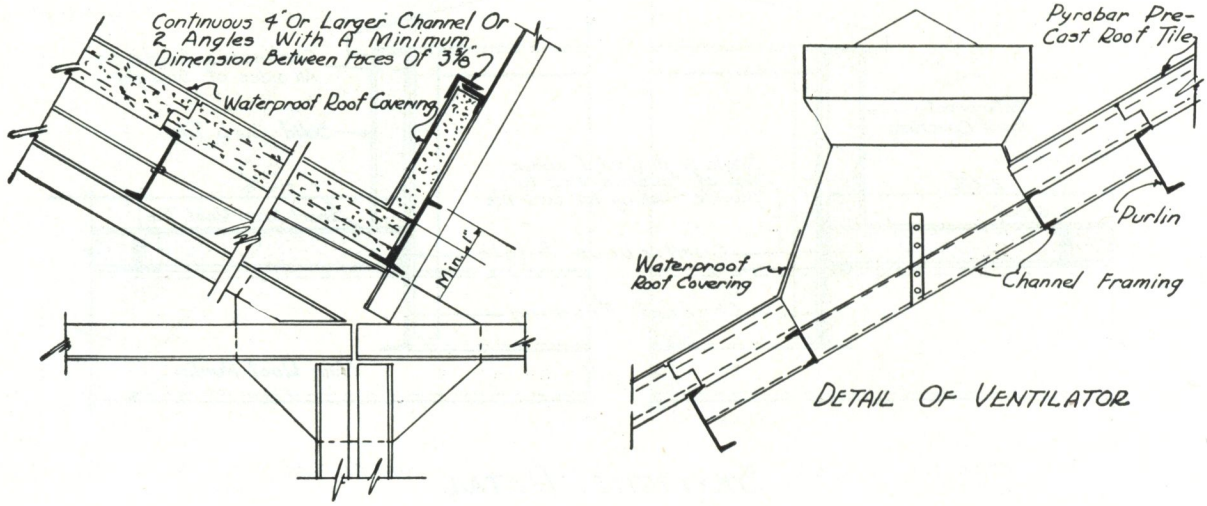


TYPICAL GABLE ROOF DESIGN



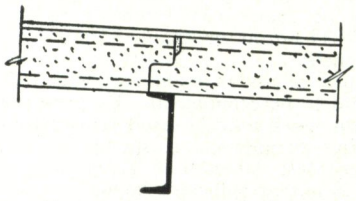




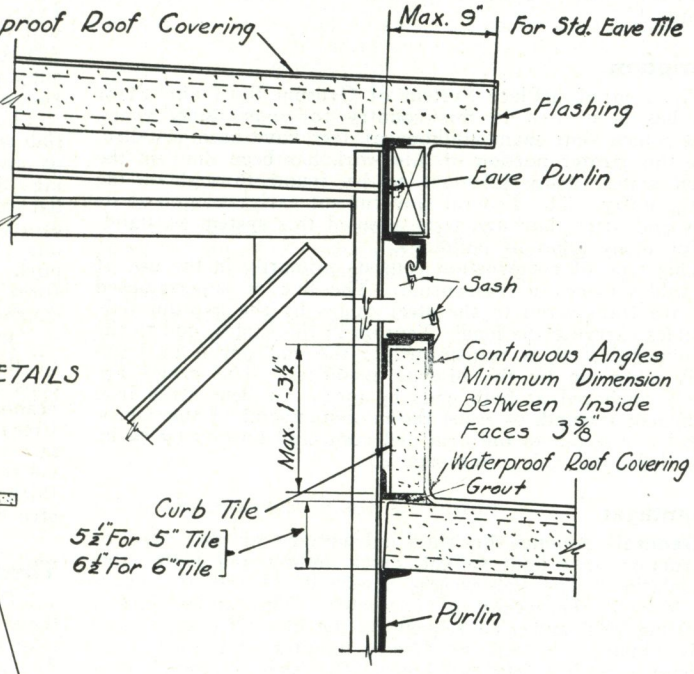
DETAIL OF VENTILATOR

DETAILS OF LONG SPAN PYROBAR ROOF TILE

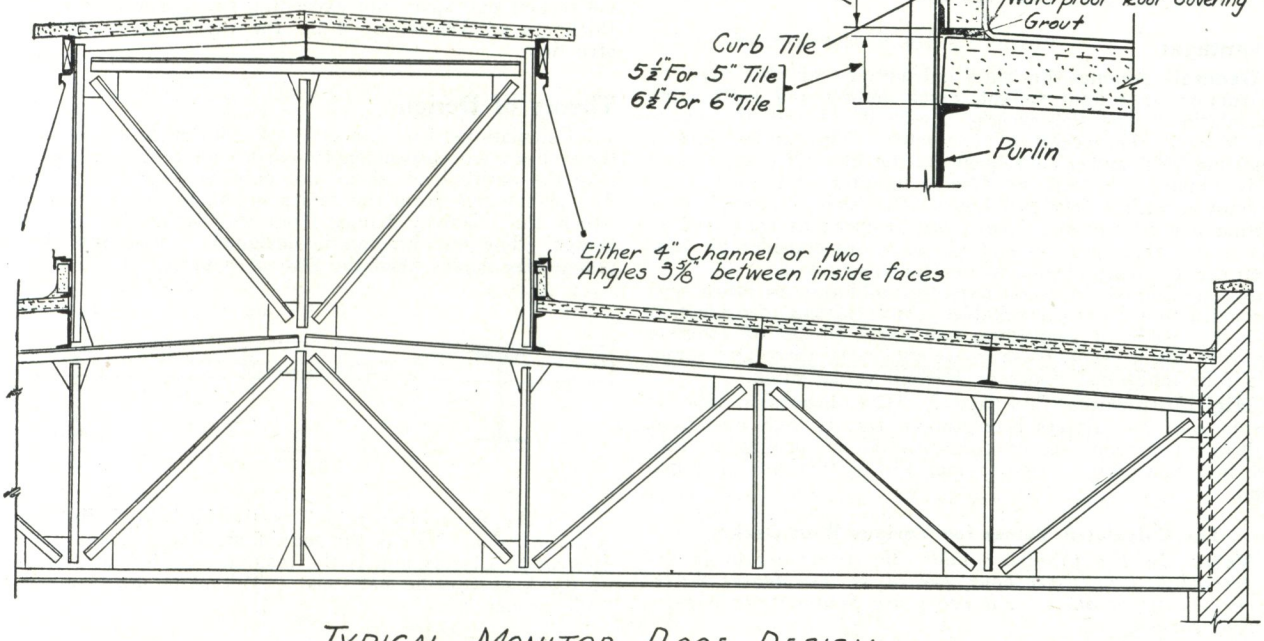
Continued on next page



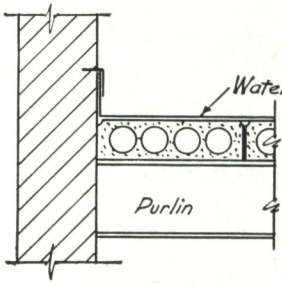
NOTE – Where Channel Purlins Are Used Lap Joint Tile Should Be Used. Notch Tile On Slopes.

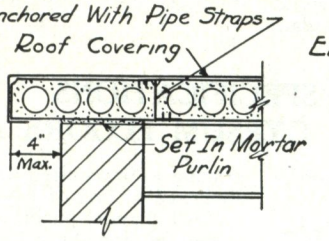


ENLARGED MONITOR DETAILS



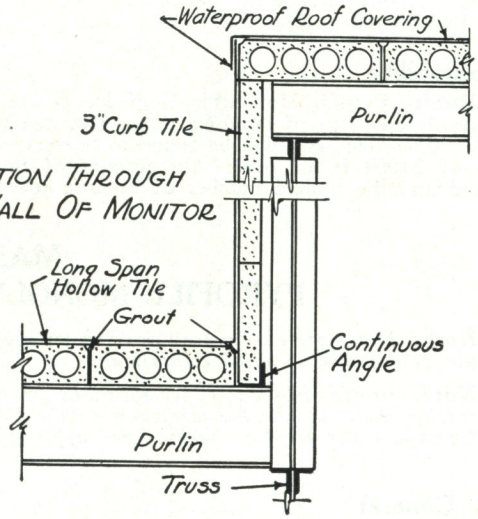
TYPICAL MONITOR ROOF DESIGN





END SECTIONS

SECTION THROUGH END WALL OF MONITOR



DETAILS OF LONG SPAN PYROBAR ROOF TILE

Continued on next page

PYROFILL MONOLITHIC GYPSUM FLOORS AND ROOFS

Note: For "Gypsum—General Technical Data," see page 1.

Description

The Poured-in-Place System of Gypsum Roof and Floor Slabs has been used in this country for over thirty years, during which time many millions of feet have been installed. While the greater portion of this work has been done in the eastern states, many jobs are to be found throughout the entire country. The Federal Government early recognized its merits and after thorough tests adopted this system as standard for many types of buildings.

This type of construction consists primarily in the use of steel cables placed in suspension. The live or superimposed loads are transferred to the steel cables by the gypsum slab, the cables carrying the load. Tension in the cables, due to the superimposed load, is transmitted to the end purlin or beam and is taken up by the bracing members. The cables are securely anchored at both ends by means of bent strap iron of sufficient strength to resist the maximum pull of the cables. The cables are put in uniform deflection and tension by ⅝ in. round deflection rods. See page 20.

Advantages

General—Among the chief advantages of this type of construction are: light weight, quick setting and high value of insulation. The slab weighs but 55 lb. per cu. ft. (Less than 40% of the weight of concrete). This allows lighter supporting steel and a consequent saving in total cost. Initial set is obtained in ten to fifteen minutes and forms can be removed with safety two hours after slab is poured, thus effecting a saving in the form work required as compared to concrete construction. As Pyrofill generates considerable heat in setting, it is adaptable to winter construction

For additional floors on existing buildings, no other type of construction is more suitable. Any existing construction which is capable of supporting two extra stories of concrete may, with the same increase in weight, carry three and sometimes four additional floors of Pyrofill construction.

High Insulation—See page 2. The suspension type of gypsum roof has always been known for its high insulation, resulting in a reduction of condensation and saving in fuel. Authentic data on insulation savings will be furnished on application.

The Calculated Values for Various Roof Decks

Note: In the following table, the transmission is expressed in B.t.u.'s per hour, per sq. ft., per degree difference in temperature. All roofs are figured with a 5-ply roof covering.

3-in. Pyrofill—Monolithic Slab	.325 B.t.u.'s
3½-in. Pyrofill—Monolithic Slab	.296 B.t.u.'s
4-in. Pyrofill—Monolithic Slab	.272 B.t.u.'s

Adaptability

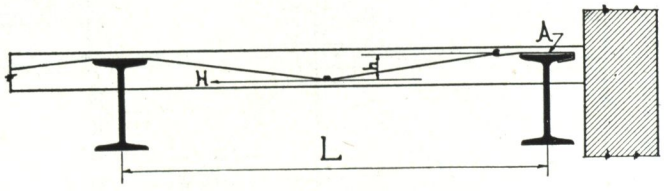
Roofs—Pyrofill Monolithic Roof Decks are adaptable to practically any type of building, either flat, monitor, sawtooth, Pond, Aiken, etc., and will be found to be very economical on jobs of 20,000 ft. or over. On account of the form work needed and the limited number of re-uses, jobs smaller than this will not be found as economical as Sheetrock-Pyrofill Poured System or Precast Tile. The cost of this type of roof will vary with the following conditions: (1) Length of span; (2) Uniformity of span; (3) Pitch of roof; (4) Type of supporting steel—(I-beams or channels); (5) Length of cable run, anchor to anchor.

Usually a span of six to eight feet with a 3-in. or 3½-in. slab will be found to be economical. By preserving uniformity of span, the form work may be used repeatedly without altering; thus effecting an appreciable saving in final cost. While flat roofs require less labor than steep ones, the difference up to 30° pitch is not of sufficient importance to warrant serious consideration on the part of the designer. On a roof pitch of 45° or over, however, it may be necessary to back form from the top, in order to get a good job. This, of course, adds to the cost of the roof.

Floors—The general principles of design and installation of this type of construction are equally applicable to floor construction, except that in strictly fireproof construction, the beams, girders and columns are fireproofed with Pyrofill or Precast Pyrobar Beam Covering. Because of the heavier loads met with in floor design compared with those in roof design we recommend spans not exceeding six or seven feet with slab thickness of 3½ in. or 4 in. for the most economical construction.

Theory of Design

Calculations for this type of construction are based on the well-known suspension bridge formula, in which the cables take the entire load, shear not entering into the calculations. The slab hangs from the cables in much the same manner in which the roadway hangs from the cables of a suspension bridge. The end bracing is designed to take the dead load pull of the cables until the slab is in place.



In the figure above "H" is the horizontal pull per foot width of slab. "S" is the maximum stress in the cables per foot width of slab and is the resultant of "H" and the weight of the load for the half span. Taking moments about point "A," we have:

$$Hh - \frac{WL}{2} \times \frac{L}{4} = 0$$

$$H = \frac{WL^2}{8h}$$

$$S = \sqrt{H^2 + \frac{(WL)^2}{(2)^2}}$$ which reduces to

$$S = \frac{WL^2}{8h}\sqrt{1 + \frac{16\,h^2}{L^2}}$$ which is used in calculating the cable spacing.

MASTER SPECIFICATIONS
PYROFILL MONOLITHIC GYPSUM FLOORS AND ROOFS

Note: Notes are explanatory or advisory only and should not be included in the specifications.

Note: Provide in the steel specifications that the steel contractor shall submit shop drawings to the United States Gypsum Company *for checking and approval.*

(1) General

(1a) All structural steel members shall be furnished in accordance with the United States Gypsum Company's details for Monolithic Gypsum Floor and Roof Construction designed to carry the prescribed live loads.

(1b) The steel contractor will provide steel framing around all openings larger than 12 in. in diameter and such steel bracing as is required to take the horizontal pull of cables where anchored at end of bays and at all openings.

All channel purlins, at ends of bays and openings, acting as anchorage for the cables, shall open away from the cables to furnish proper support for the clips.

(1c) All openings for (down spouts) (soilpipes) (vents) (specify) etc. shall be accurately located on the forms by others before the slabs are poured.

(2) Work Included

Note: Here list and locate the various floor and roof areas to be constructed of Pyrofill Monolithic Gypsum Floor and Roof Construction and specify the prescribed live loads. If live loads for floors vary, designate the live load applying to the various areas.

Continued on next page

(3) Materials

(3a) General—All Gypsum products shal be as manufactured by the UNITED STATES GYPSUM COMPANY, 300 West Adams Street, Chicago, Ill.

(3b) Forms—Forms shall be of tongue and groove dressed lumber of grade to assure level, true slab thicknesses.

(3c) Reinforcing—Reinforcing shall consist of galvanized steel cables made by twisting two No. 12 wires. The cables shall be calculated to take the entire slab load and shall be provided with suitable end fastenings at their ends to develop the full strength required. In no case shall the stress in the cables exceed 20,000 lb. per square inch or more than 20% of the ultimate strength. Furnish ⅝-in. round steel tension rods for center of each slab span.

(3d) Pyrofill—Pyrofill (Gypsum Fiber Concrete) shall consist of calcined gypsum and sufficient clean water for proper consistency and not to exceed 12½ lb. of clean soft wood planer shavings to every 87½ lb. of gypsum. It shall be *(mill) (field)* mixed.

Curbs, etc.—All *(curb walls) (ends of monitors) (specify)* shall be constructed of *(3-in. Pyrobar Curb Tile, reinforced if restraining drainage fill or carrying roof loads) (poured Gypsum Pyrofill).*

(4) Erection

(4a) By United States Gypsum Co.—All Pyrofill Monolithic Gypsum *(Floor) (and) (Roof)* construction, including all *(curbs) (end walls) (saddles) (drainage fill),* shall be completely erected by the Contracting Division of the UNITED STATES GYPSUM COMPANY.

Note: *For Erection Service, see page 1.*

(4b) Forms—Forms shall be made in a substantial, workmanlike manner, carefully leveled to insure a uniform depth of slab. They shall be cleaned before each re-use, and shall be wet down immediately before placing the Pyrofill.

(4c) Reinforcing—The spacing of cables and the depth of the slab shall conform to the standards of the UNITED STATES GYPSUM COMPANY. Cables shall be drawn tight and rigidly fastened to anchors and brought to uniform tension. Exercise care in placing tension rods that the cables shall not be brought closer than ½ in. to the undersurface of the slab. After cables are in place all workmen of this and other contractors shall be prohibited from walking thereon.

(4d) Slabs—Pyrofill (Gypsum Fiber Concrete) shall be poured upon the forms completely surrounding the reinforcing cables. The top surface of the slab shall be screeded to as smooth a surface as practical to receive the *(floor) (and) (waterproof roof covering).*

(4e) Curbs—All curbs indicated on plans and details shall be built of *(Pyrobar Curb Tile) (poured Gypsum Pyrofill);* when restraining drainage fill or carrying roof loads curbs shall be reinforced.

(4f) End Walls, etc.—Where indicated on plans and details construct end walls of *(monitors) (sawtooth skylights) ("A" frames) (specify)* of *(Pyrobar Curb Tile) (poured Gypsum Pyrofill).*

(4g) Drainage Fill, etc.—Provide Pyrofill saddles and drainage pitches to direct roof drainage to *(gutters) (drainage outlets).*

(5) Waterproof Roof Covering

Note: *Provide in the Roofing and Sheet Metal division of the specifications that the waterproof roof covering shall be applied as soon as possible after the gypsum roof slab is erected (preferably within twenty days). Do not plaster or paint underside of roof slabs until waterproof roof covering has been applied and the slab is thoroughly dry.*

Note: *Include in Roofing and other specification divisions where applicable that plank runways shall be laid on the slab before any wheeling is done. Planks shall be laid from purlin to purlin to take any heavy or concentrated loads which may be applied to the slab.*

CABLE SPACING AND SLAB DEPTHS FOR VARIOUS LOADS AND SPACES

Cables stressed to 20,000 lb. per sq. in. See page 18 for formulas used in calculations

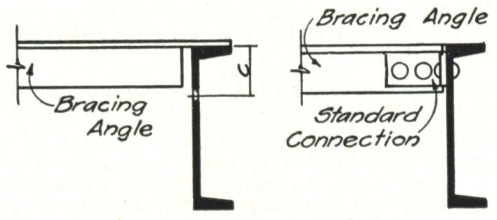
Depth of slab, in.	Wt. of slab per sq. ft., lb.	Cable spacing, in.	PYROFILL MONOLITHIC FLOOR AND ROOF CONSTRUCTION SAFE SUPERIMPOSED LOADS IN POUNDS PER SQUARE FOOT OF SLAB												
			3′-6″	4′-0″	4′-6″	5′-0″	5′-6″	6′-0″	6′-6″	7′-0″	7′-6″	8′-0″	8′-6″	9′-0″	9′-6″	10′-0″
3	12	1	...	...	...	...	172	142	120	102	...	...	...	...	...	...
		1¼	...	...	...	166	134	111	94	79	...	...	...	...	...	...
		1½	...	...	170	136	111	91	76	63	...	...	...	...	...	...
		1¾	...	...	144	115	93	76	63	53	...	...	...	...	...	...
		2	...	161	125	99	80	65	54	45	...	...	...	...	...	...
		2¼	...	142	110	87	70	56	47	39	...	...	...	...	...	...
		2½	168	126	97	77	62	50	41	34	...	...	...	...	...	...
		2¾	151	114	88	69	55	44	36	29	...	...	...	...	...	...
		3	138	103	79	62	49	39	32	...	...	...	...	...	...	...
3½	14	1	...	...	...	...	...	...	150	128	110	95	...	...	...	...
		1¼	...	...	...	...	169	141	118	100	85	73	...	...	...	...
		1½	...	...	...	170	139	114	96	81	69	59	...	...	...	...
		1¾	...	...	...	144	117	96	80	67	57	48	...	...	...	...
		2	...	...	156	124	100	82	68	57	48	40	...	...	...	...
		2¼	...	...	137	109	88	72	59	49	41	34	...	...	...	...
		2½	...	160	122	97	78	63	52	43	36	30	...	...	...	...
		2¾	...	142	109	87	69	56	46	38	31	26	...	...	...	...
		3	171	129	99	78	62	50	41	33	27	...	...	...	...	...
4	16	1	...	...	...	...	...	...	...	154	133	114	100	87	77	68
		1¼	...	...	...	...	...	168	141	120	102	88	76	66	58	51
		1½	...	...	...	...	166	138	115	97	81	71	61	53	46	40
		1¾	...	...	...	172	140	116	96	81	69	59	50	43	37	32
		2	...	...	...	149	121	99	82	69	58	49	42	36	30	26
		2¼	...	...	164	130	105	86	71	59	49	42	35	30	25	...
		2½	...	...	146	116	93	76	63	52	42	36	30	25	...	...
		2¾	...	169	131	103	83	68	56	46	37	31	...	...	...	...
		3	...	154	118	94	75	61	50	41	33	27	...	...	...	...
4½	18	1	...	...	...	...	...	...	...	...	151	134	117	102	90	79
		1¼	...	...	...	...	...	...	...	140	117	103	90	78	68	60
		1½	...	...	...	...	...	160	134	114	94	83	72	62	54	47
		1¾	...	...	...	...	163	135	112	95	78	69	59	51	44	38
		2	...	...	...	...	140	115	96	81	66	58	49	42	36	31
		2¼	...	...	...	152	123	101	83	70	57	49	42	35	30	25
		2½	...	...	...	135	109	89	73	61	49	43	36	30	25	...
		2¾	...	...	152	121	97	79	65	54	43	37	31	26	...	...
		3	...	...	138	109	88	71	58	48	38	33	27	22	...	...
5	20	1	...	...	...	...	...	...	...	...	...	153	133	117	103	91
		1¼	...	...	...	...	...	...	...	160	137	118	103	89	78	69
		1½	...	...	...	...	...	...	153	130	111	95	82	71	62	54
		1¾	...	...	...	...	...	154	128	108	92	79	68	58	50	43
		2	...	...	...	...	160	132	110	92	78	66	57	48	42	36
		2¼	...	...	...	...	140	115	95	80	67	57	48	41	35	29
		2½	...	...	...	153	124	102	84	70	58	49	41	36	29	24
		2¾	...	...	...	137	111	90	74	62	51	42	36	30	25	20
		3	...	...	153	124	100	81	67	55	45	38	31	26	21	...

Continued on next page

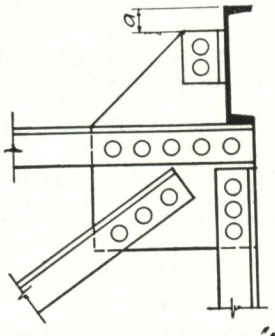
On page 19 will be found a table giving the safe superimposed loads for different depths of slabs, cable spacing and various spans of beams and purlins. These values have been given for the convenience of the designer. Below will be found the size of bracing members for end purlins. In designing a poured gypsum floor or roof, the end purlin must be so designed that it will withstand a lateral pull as well as the direct load, without excessive deflection and without exceeding the allowable stresses.

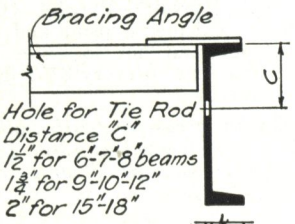
For ordinary roof loadings, the end member which usually consists of a channel will be found to have sufficient strength to take this lateral pull when braced as shown below. When heavier loadings are involved an I-beam or built-up member of this ⌋⌈ or this ⌋⌐ type will be found very efficient for stiffening action for short span purlins without the use of bracing angles and tie rods. The tops of the bracing angles must frame flush with tops of beams. Holes for tie rods should be placed so that the tie rod will come in the center of the slab or be thoroughly embedded after the slab is poured.

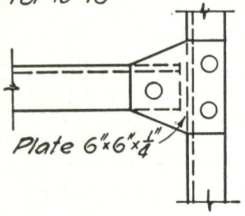
BRACING		
SPAN	ANGLE	ROD
7'-0" OR LESS	2" x 2½" x ¼"	5/8" ϕ
7'-0" TO 8'-0"	2½" x 2½" x ¼"	5/8" ϕ
8'-0" TO 9'-0"	3" x 2½" x ¼"	¾" ϕ
9'-0" TO 10'-0"	3" x 3" x ¼"	¾" ϕ



CONNECTION AT "B"

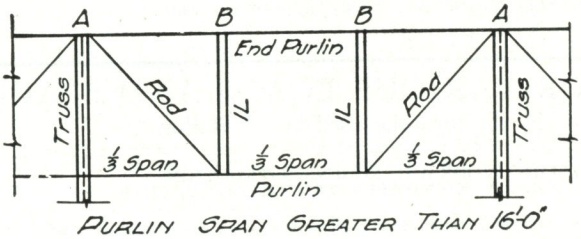




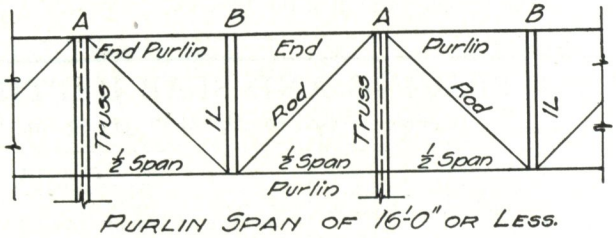


CONNECTION AT "A"

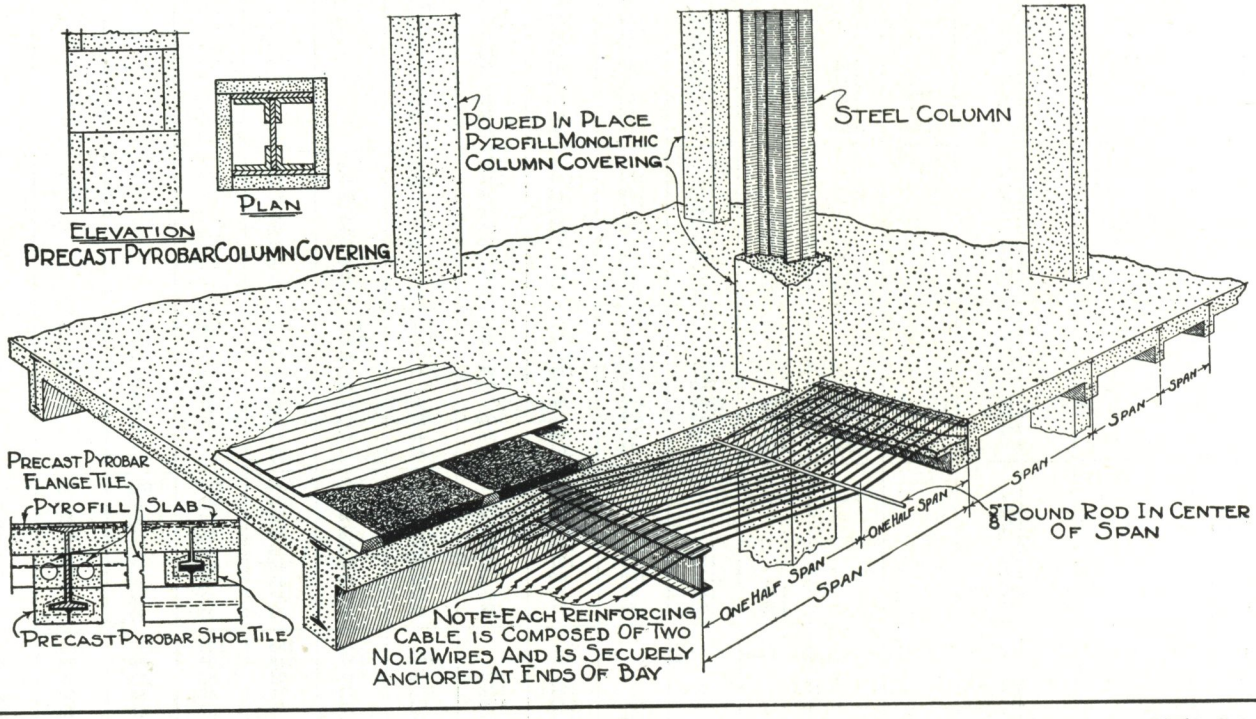
Dimension "a" to be 1½" for 15" ℄ and 1" for all smaller ℄. When I beams are used make "a" as small as possible.



PURLIN SPAN GREATER THAN 16'-0"



PURLIN SPAN OF 16'-0" OR LESS.



DESIGNING DATA—PYROFILL MONOLITHIC CONSTRUCTION

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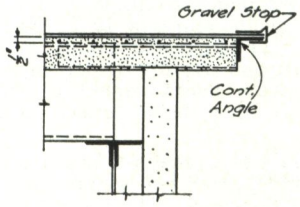
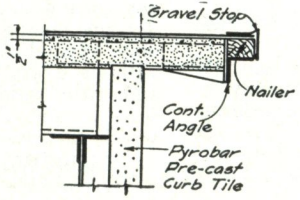
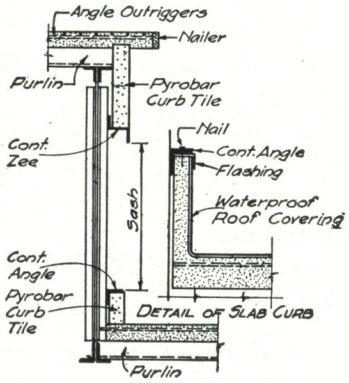
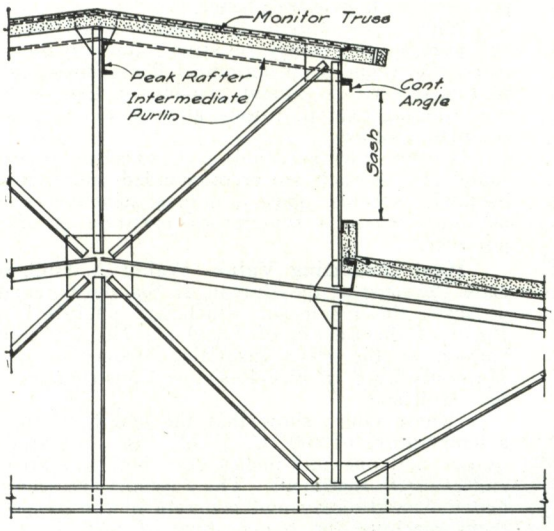
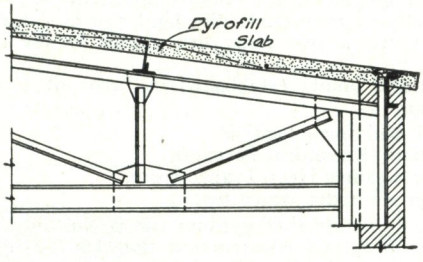


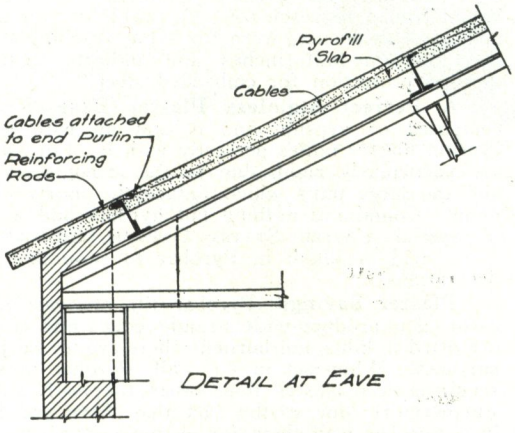




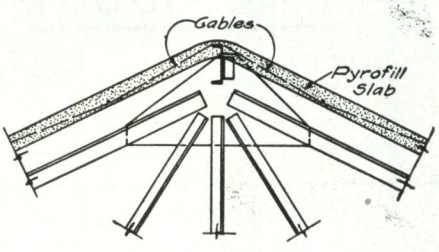




TYPICAL MONITOR CONSTRUCTION



DETAIL AT EAVE



DETAIL AT RIDGE

DETAILS—PYROFILL MONOLITHIC CONSTRUCTION

Continued on next page

PYROBAR PARTITION AND FURRING TILE
PYROBAR COLUMN, BEAM AND GIRDER FIREPROOFING

Description

Note: For "Gypsum—General Technical Data," see page 1.

Pyrobar Gypsum Tile consist of 97% gypsum and 3% special wood fiber. They are moulded in steel moulds by continuous automatic machine process, which insures accurate proportions and an even distribution of gypsum, fiber and water, resulting in tile of uniform size, weight, strength and density.

Physical Characteristics

Fireproof—See particularly page 1. The claims for Pyrobar Tile as a fireproof building material are based upon many tests which have been conducted by recognized authorities over a period of twenty-five years.

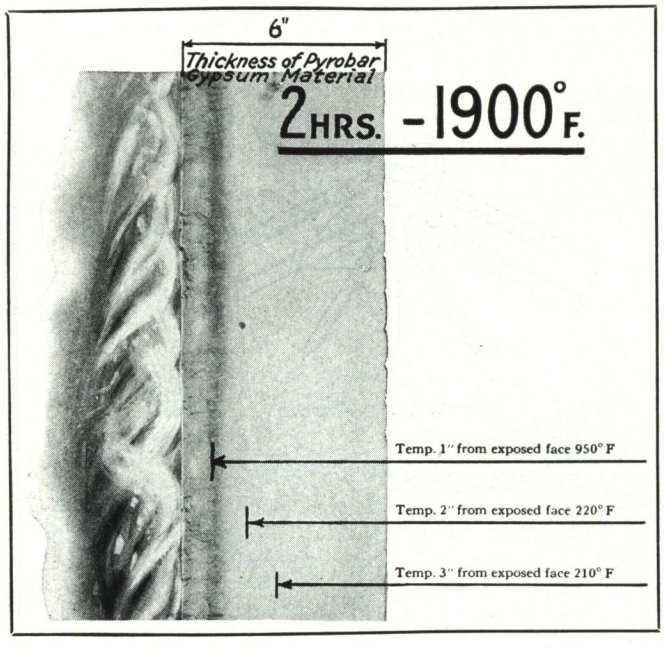
A complete list of authoritative tests will be furnished on request.

Outstanding among the many tests made to obtain favorable rating and to pass the requirements of various district rating bureaus is that conducted at the Underwriters' Laboratories on June 22, 1910. This test was made on a 3-in. hollow Pyrobar partition, plastered on both sides with Gypsum plaster to ½-in. grounds. The partition was subjected to a fire on one side for a period of two hours and the temperature reached 1700° F. in the first 30 minutes and remained at that point for the next 90 consecutive minutes. At the end of two hours a ⅞-in stream of water was applied to the heated side of the panel at a pressure of 50 lb. per sq. in. at a distance of 20 ft. for a five minute period, the object being to determine the structural strength of the Pyrobar wall after such a fire test. The average temperature on the unexposed surface was 166° F., an increase of only 90° above the room temperature of 76° F. Based on the results of these tests, the Underwriters' Laboratories, Inc., has given a two hour fire rating to the above partitions.

The four definite points established in favor of Pyrobar Tile by this test are:

(1) Fireproof and Incombustible
(2) Retention of Structural Strength
(3) Insulation against Heat Transmission
(4) Shatter-proof under water test.

It is significant to note that gypsum tile is the only partition tile used for fireproof construction that has passed the test requirements of the Underwriters' Laboratories, Inc.



Results of Fire Tests Made by Underwriters' Laboratories, Inc., on Gypsum Tile

The tile were subjected to a constant temperature of 1900° F. for two hours. At the end of that time, the temperature of tile, 2 in. away from the flame was but 220° F.

Does Not Expand or Contract—Precast Gypsum does not expand or contract under ordinary conditions. Even under the average fire temperatures a 10 ft. Pyrobar wall will only expand ⅛ in. Other incombustible materials, almost without exception, expand rapidly under high temperatures and, held rigidly between floors, cannot expand except outwardly, and therefore they bulge, crack, spall and finally wreck themselves.

Light Weight—Pyrobar Precast Gypsum Tile Partitions are from 25% to 50% lighter per square foot than ordinary building tile of equal thickness. The use of Pyrobar Tile materially reduces the dead load, effecting worth while savings in steel in columns, girders, beams or other supporting members. Light weight likewise means a saving in freight, hauling, hoisting and labor costs. See Table of Weights, pages 23 and 25.

Non-conductor of Sound—Unless a partition is properly constructed with the purpose of excluding sound, the benefits derived by the use of a soundproof partition are lost. Authentic tests show that less than 1/100 of one per cent of incident sound is transmitted through a gypsum tile partition plastered with gypsum plaster.

When pipes occur in partitions or when doors and transoms are present, the sound resistive value of the construction is materially reduced. Continuous floor finish under a partition, particularly if of cement, marble or tile, or suspended ceilings running over partitions, all tend to carry sound from one room to another.

Gypsum tile partitions are excellent non-conductors of sound and as such are recommended and successfully used in hospitals, schools, office buildings, apartments, hotels and all buildings where a soundproof partition is of particular importance.

Heat Insulating Value—Walter A. Hull, formerly Associate Physicist at the Bureau of Standards, conducted a series of tests, the results of which are published in Technologic Paper of the Bureau of Standards No. 130 entitled, "A Comparison of the Heat Insulating Properties of Some of the Materials Used in Fire Resistive Construction." In this paper Mr. Hull states:

"These tables show that the length of time required for a temperature of 600° C. (1112° F.) to be attained at a depth of one and one-half inches does not vary greatly in the clay and concrete specimens. The gypsums are seen to be distinctly better than the clay and concrete in this respect, only one of them reaching the temperature of 600° C. (1112° F.) at a depth of one and one-half inches in the three and one-half hour test."

It is of considerable interest to note that of twenty-eight gypsum specimens tested, only one of them reached the temperature of 600° C. at a depth of one and one-half inches in the three and one-half hour test. Mr. Hull comments on this as follows:

"Obviously the gypsum specimens and the one of radix having failed to reach 600° C. (1112° F.) at a depth of one and one-half inches, were far from reaching it at a depth of two and one-half inches and indicate distinctly superior thermal protection for embedded steel."

A Perfect Stainless Plaster Base—Since Pyrobar is composed of gypsum and is laid up with gypsum mortar, gypsum plaster unites perfectly with it. Pyrobar constructions are particularly rigid, due to the strength of the tile itself and the large units which reduce the mortar joints to minimum. Containing nothing but gypsum and a small per cent of special United States Gypsum Company fiber, there is no acid or alkali in Pyrobar to stain the plaster or wall decorations.

Plaster Savings—Pyrobar tile are cast in steel moulds assuring a product with straight edges and true faces. They are dried in kilns, not burned—there are no warped or distorted surfaces. When set in the wall, Pyrobar presents a surface requiring less plaster than other fireproof wall construction. Furthermore, due to the fact that there are 40% less joints in a Pyrobar wall than, for example, in a clay tile wall, there is a considerable saving in setting mortar.

Economical—Breakage is almost negligible and the small pieces of waste from cutting and fitting can be utilized. Definite other economies affecting steel and handling are established in "Light Weight" above; plaster in the preceding paragraph, and labor in "Quickly Erected" under heading "Advantages" on the next page.

Low maintenance is assured due to permanence, fireproofness and stainlessness.

Continued on next page

Erection Service

Where desired, Pyrobar Tile are completely erected by the U.S.G. Contracting Division. See page 1.

Approved Uses

In the following classes of fireproof construction, Pyrobar Precast Gypsum Tile are approved by the Underwriters' Laboratories, Inc., and most city building codes.

Non-bearing corridor walls, partitions, wall furring and false columns and pilasters. Partitions and corridors in merchandise storage warehouses.

Fire division walls.

Elevator, stairway, dumbwaiter and corridor enclosures.

Light wells, pipe chases, heat and vent ducts.

As covering for columns, beams, girders, trusses and other steel members requiring fireproofing.

Floor fill, instead of cinder concrete fill.

Insulation on concrete roofs.

PYROBAR PARTITION AND FURRING TILE AND COLUMN COVERING

Description

Partition and Furring Tile—A Pyrobar tile is 30 in. long, 12 in. high and of various thicknesses from 1½ to 6 in. For complete sizes and weights, see table below.

Smooth face tile are made for warehouse and similar use where the furring and partitions are to remain unplastered.

Pyrobar tile meets fully the standard specifications for Gypsum Partition tile or block of the American Society for Testing Materials.

For the protection of owners, architects, engineers and contractors, all Pyrobar Gypsum Tile bear the trade-mark.

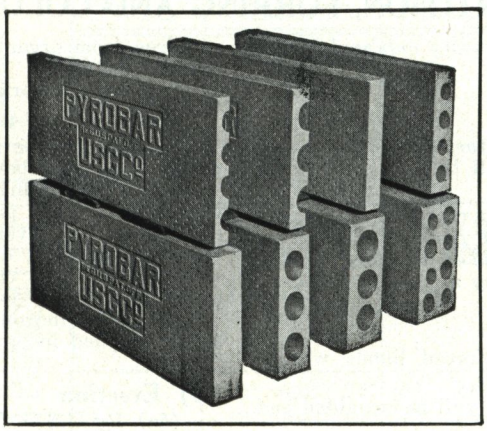
Column Covering—Column fireproofing is accomplished either with 2 in. solid or 3 in. hollow Pyrobar Partition Tile. When desired, or required by a building code, the space between the covering and the steel may be solidly backfilled with pieces of Pyrobar Tile and gypsum mortar. A digest of reports giving tests on gypsum fireproofing is available on request.

Advantages

Alterations Easily Accomplished—Openings in Pyrobar Tile walls may be accurately cut with a saw. Thus alterations are speedily and cheaply made by one mechanic. Trim, fitted over the edges of the tile effectively hides the alteration, saving replastering and redecorating. In most cases the tile removed can be salvaged for other work.

Quickly Erected—Each unit of Pyrobar installed is two and one-half sq. ft. These light 12x30-in. units are handled readily and erected quickly. The average mechanic will lay up more Pyrobar than clay tile in a day and do a neater and more workmanlike job because of the accurately true size and shape of the unit. Pyrobar is easily and quickly sawed to fit around difficult pipe chases, etc., which ordinarily slow up the work. Even curved work is easily accomplished.

Grounds Easily Provided For—Grounds for the attachment of fixtures and wood trim are securely attached to easily installed staggered nailing plugs or nailing blocks. See details, page 27.



Recommended Thickness—Partition and Furring Tile

Pyrobar Gypsum Tile for furring and partitions are made in standard face dimensions (12x30 in.) in both solid and hollow types, and various thicknesses to meet Underwriters' standards and the building codes of the various cities. For table of sizes and weights, see below.

The thickness of the partition should be determined primarily by the ceiling height and by its location. As a rule 3 or 4-in. tile is the thickness used for the average building where partitions do not exceed 15 ft. in height. Corridor partitions are generally thicker than transverse partitions.

Two-inch solid Pyrobar Tile are used for partitions not exceeding 10 ft. in height and for covering columns, constructing pipe chases, vent ducts, dumbwaiter shafts, etc.

Split and hollow Pyrobar Furring are laid up against exterior walls and securely spiked every square yard. Joints should be broken the same as for partition work. Furring may also be fastened to the building wall by means of wall ties built into the masonry. The hollow portion of the tile should be placed against the walls, thus minimizing the contact area with the outside walls.

Where furring stands free from the wall, allowing space for pipes, vents, etc., it is customary to use 2-in. solid or 3 or 4-in. hollow Pyrobar Tie to assure necessary rigidity.

Free standing furring should be anchored to the exterior wall either by dwarf walls between the furring and exterior wall, or by building into the exterior wall corrugated metal wall ties of sufficient length to span the space and be embedded in the furring tile joints.

Set Fast Cement

This is a specially prepared gypsum cement used with water and sand as a mortar for setting gypsum partition tile, and gypsum fireproofing and column covering. It is also extensively used as a mortar for interior clay tile partitions and fireproofing. Its easy working qualities together with the early setting of the gypsum makes Set Fast Cement Mortar ideal for economical, rigid mortar joints in all interior tile work.

SIZES AND WEIGHTS OF PYROBAR PARTITION AND FURRING TILE

Size of Pyrobar, Gypsum Tile, In.	For ceiling heights up to	Weight tile per sq. ft., lb.	Weight mortar per sq. ft., lb.	Weight plaster, one side, per sq. ft., lb. ½ in. grounds	Total weight plastered, one side, per sq. ft., lb.	Weight plaster two sides per sq. ft., lb.	Total weight plastered, two sides, per sq. ft., lb.
1½-in. Split—1½x12x30	Furring†	4.9	1.4	3	7.9		
2-in. Split—2x12x30	Furring†	6.4	1.4	3	9.4		
2-in. Solid—2x12x30	10 feet*	9.4	1.5	3	12.4	6	15.4
3-in. Hollow—3x12x30	13 feet*	9.9	2.0	3	12.9	6	15.9
3-in. Solid—3x12x30	15 feet†	13.0	2.0	3	16.0	6	19.0
4-in. Hollow—4x12x30	17 feet*	13.0	2.5	3	16.0	6	19.0
5-in. Hollow—5x12x30	20 feet*	15.6	2.75	3	18.6	6	21.6
6-in. Hollow—6x12x30	30 feet*	16.6	3.0	3	19.6	6	22.6

*Underwriters' Laboratories recommendations. †No Underwriters' recommendation.

Continued on next page

PRELIMINARY SPECIFICATION REQUIREMENTS

(Applying to Pyrobar Partitions, Furring and Column Covering)

Note: *The following should be included under other specification divisions where and when they apply.*

Note: *Notes are explanatory or advisory only and should not be included in the specifications.*

(1) Masonry Work

Note: *As stated under "Recommended Thickness," page 23, there are two methods of securing furring and the ends of partitions to the building masonry walls: (1) with 10d cut nails driven into the joints of the masonry, (2) with corrugated metal wall ties of the proper length to be built into the masonry, spanning furring space if any and to be embedded in the Pyrobar Tile joints. If method (2) is used include the following clause:*

(1a) Provide and build into masonry walls corrugated galvanized sheet iron ties to anchor the *(ends of Pyrobar partitions) (and) (Pyrobar Wall Furring)* to the masonry work.

(1b) Ties for partition ends shall be accurately set and spaced 12 in. apart on centers to build into the Pyrobar Tile joints.

(1c) Ties for furring, one for each surface, sq. yd., shall be accurately set to build into the Pyrobar Tile joints.

(2) Miscellaneous Steel Work

Note: *See details, page 27.*

(2a) All openings in Pyrobar partitions so noted on plans or schedules shall be provided with (channel bucks) (channels reinforcing wood bucks).

(2b) The lintel bucks of all openings in Pyrobar partitions over 6 ft. wide shall be reinforced with steel lintels as *(noted on plans or schedules) (as detailed).*

(3) Reinforcing Bars

All openings in Pyrobar partitions over 4 ft. wide but not over 6 ft. wide shall be provided with ½ in. steel reinforcing bars, 3 to the opening. Bars shall be 8 in. longer than the actual width of tile opening (not buck width).

(4) Carpentry Work

Note: *See details, page 27.*

(4a) Bucks—Provide wood bucks for all openings in Pyrobar partitions (except where steel bucks are indicated) (reinforced with steel channels where so indicated). Bucks shall be made of 2-in. lumber the depth of the Pyrobar Tile thickness, to the edges of which shall be secured ½x2¾-in. plaster grounds forming a rabbet to receive the tile. Bucks shall be accurately set, plumb and true and rigidly braced, so as to cause no delay or interruption in the erection of the partitions.

(4b) Nailing Blocks—Provide and nail directly to the end of Pyrobar *(partition) (and) (furring)* tile nailing blocks spaced 30 in. on centers to take all wood grounds to receive trim. Blocks shall be ⅞ in. thick and of such dimensions as will completely cover the end of the tile.

Where required to secure heavy fixtures, trim, etc., provide similar 1½-in. thick nailing blocks spaced not to exceed 15 in. on centers.

(4c) Grounds—Provide ½-in. plaster grounds to receive all trim.

(5) Miscellaneous

Note: *Heavy fixtures, etc. are best secured to Pyrobar partitions with steel plates and through bolts as detailed on page 27. Provide where required.*

(6) Plastering

Note: *For Plastering on Pyrobar, see Sweet's Manufacturer's Index for U.S.G. "Master Specifications—Interior Lathing and Plastering." Under no circumstances should Portland cement or lime plaster be used for the first coat —use only gypsum plaster.*

MASTER SPECIFICATIONS
PYROBAR PARTITION, FURRING AND COLUMN COVERING

Note: *Notes are explanatory or advisory only and should not be included in the specifications.*

(1) Work Included

All partitions *(and) (all furring for exterior masonry walls) (and) (all column covering)* shall be built of Precast Pyrobar Gypsum Tile.

Note: *If there are any exceptions, so note. List and locate any special requirements not clearly indicated on plans and details. Particularly list and locate where smooth face tile are to be installed requiring no plaster finish.*

(2) Preliminary Provisions

(2a) All reinforcing bars for reinforced lintels will be furnished by others.

(2b) All rough bucks for openings will be provided and accurately set by others.

(2c) All wood nailing blocks to receive grounds, etc., will be provided and attached to tile by others.

(3) Materials

(3a) General—All gypsum tile and cement shall be as manufactured by the UNITED STATES GYPSUM COMPANY.

(3b) Partition Tile—Pyrobar of thicknesses indicated on plans. *(Pipe chases) (small shafts) (heat) (and) (vent) (ducts)* etc. shall be constructed preferably with 3-in. Hollow Pyrobar, otherwise of 2-in. solid Pyrobar.

Note: *See "Recommended thickness," page 23.*

Where no plastering is required, tile shall be smooth face.

(3c) Furring Tile—Pyrobar *(split) (solid) (specify thickness).*

Note: *See "Recommended thickness," page 23.*

Where no plastering is required, tile shall be smooth face.

(3d) Column Covering—Pyrobar (2-in. solid) (3-in. hollow).

(3e) Mortar—Sand for mortar shall be clean and sharp and free from organic matter with grains graded from fine to coarse.

Cement for mortar shall be Setfast Gypsum Cement.

Note: *Do not use portland cement or lime.*

Mortar shall be mixed in a clean mortar box in the proportions of one part of cement to three parts of sand, by weight and sufficient clean water to bring to the right consistency. First place a layer of sand in the high end of the mortar box, over which spread a layer of cement. Hoe dry from one end of the box to the other and back again, working sand and cement thoroughly together to a uniform color. Put water in low end of box and hoe mortar into water mixing thoroughly. Do not mix more material than can be applied in approximately one hour. Do not retemper.

(4) Erection

(4a) By U.S.G. Co.—All Pyrobar *(partitions) (and) (furring) (and) (column-covering)* shall be completely erected by the UNITED STATES GYPSUM COMPANY'S Contracting Division.

Note: *See "Erection Service," page 23.*

(4b) General—All tile shall be laid in gypsum mortar with full, flush joints to a line, with horizontal beds uniformly level on each course. All joints, chinks and crevices between the tile and other work shall be filled with mortar well slushed in. Joints in alternate courses shall be broken.

All joints of smooth tile (unplastered) shall be neatly pointed smooth as the work progresses. Fill all exposed core openings at corners, etc.

All tile shall be started on the fireproof floor, set plumb straight and true, and wedged at ceiling and slushed with mortar. Tile at corners and re-entrant angles shall be laid interlocked in alternate courses.

(4c) Partitions—All partitions coming in contact with existing walls shall be rigidly anchored, *(by driving 10d spikes driven into the mortar joints of the wall at the joints of each partition tile course) (by building in at each partition tile course metal ties provided and built into the masonry by others.)*

Continued on next page

Note: *Select clause which applies. See under "Masonry Work," on page 24.*

(4d) Furring—Furring shall be laid *(against) (or) (free from)* the walls as shown on the plans and details.

Rigidly anchor the furring tile to the masonry wall every square yard of face area *(by 10d spikes driven into the mortar joints of the wall at the course joints of the furring tile) (by building in at the furring tile course metal ties provided and built into the masonry by others).*

Note: *Select clause which applies. See under "Masonry Work," on page 24.*

(4e) Column Covering—A single thickness of tile shall be laid against the outside edges of the steel (and the space between the tile and steel shall be solidly backfilled with pieces of Pyrobar tile and gypsum mortar).

Note: *Include or omit clause covering backfilling as required. See last paragraph under "Description," page 23.*

(4f) Buck Anchors—Anchor all wood bucks to tile by 10d cut nails driven into the buck at each tile course or other approved metal anchor.

(4g) Lintels—Lintels shall have at least 4-in. bearing at each end on the tile beneath. Openings not over 22 in. wide shall be spanned by a single tile. Lintels over openings more than 22 in. and not over 4 ft. wide shall be laid in the form of a jack-arch. Lintels over openings more than 4 ft. and not over 6 ft. wide shall be reinforced with steel rods set in the tile voids flushed full with mortar. Lintels over openings more than 6 ft. wide shall be provided with steel lintel furnished by others.

PYROBAR BEAM AND GIRDER FIREPROOFING

Description

Pyrobar Beam and Girder Fireproofing is made from the same materials and in the same manner as Pyrobar Partitions and Furring Tile, described on page 23.

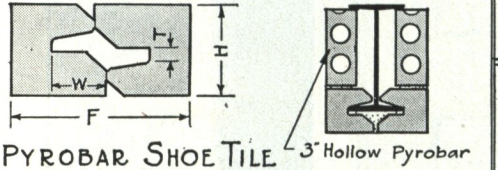
Pyrobar Shoe Tile, which fit over the lower flanges of the steel, in combination with Pyrobar Partition Tile for side protection are used as beam fireproofing for sections with a flange width not over 9 in., as indicated below. A Pyrobar Shoe Tile is moulded in a double unit, 18 in. long, sufficient for a foot and a half of beam. It is light in weight, easily split, and placed with a minimum quantity of mortar and labor. The double unit reduces breakage, and provides protection for the inner edges during shipment and handling.

For rolled sections and built-up members covered to a depth not exceeding 36 in., all with a flange width greater than 9 in., Pyrobar Soffit Tile, 2 in. thick, are used in combination with Pyrobar Partition Tile for side covering. The Soffit Tile with supporting strap imbedded, project beyond the flanges of the member, providing a support for the side covers. The Soffit Tile is specially moulded at the mill of the proper width, with straps imbedded to act as reinforcement for supporting the tile. It is shipped in units 24 in. long.

For deep built-up members with cover plates, rivets, etc., Pyrobar Angle Tile in combination with Pyrobar Soffit Tile, either 2 in. solid or 3 in. hollow, are used. Angle Tile are shipped in single units 18 in. long, two Angle Tile being required per lineal foot of beam. Soffit Tile 3 in. hollow can be cut on the job from ordinary 3-in. hollow Pyrobar Partition Tile, and held in place with pipe straps.

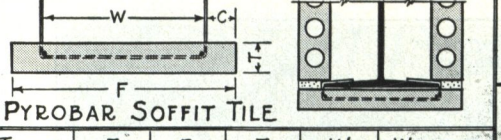
These constructions provide 2 in. of protection to all parts of the steel, and fulfill the requirements of the National Board of Fire Underwriters.

PYROBAR BEAM AND GIRDER FIREPROOFING
WEIGHTS OF DOUBLE SHOE, TWO ANGLE TILE AND SOFFIT TILE PER LINEAL FOOT OF BEAM



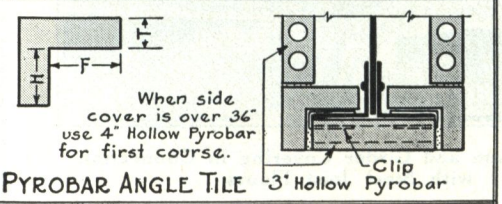
PYROBAR SHOE TILE

TYPE	F	H	T	W	WEIGHT
B-40	7⅝	4¼	½"	2"	12.5 Lbs.
B-50	8¼	4¼	⅝"	2½"	13
B-65	9¾	4¼	13/16"	3¼"	15
B-80	10½	4¼	15/16"	4"	16



PYROBAR SOFFIT TILE

TYPE	F	C	T	W	WEIGHT
S-10	15¼"	2½"	2"	10"	13 Lbs.
S-11	15¼"	2"	2"	11"	13
S-12	17¼"	2½"	2"	12"	14.5
S-13	17¼"	2"	2"	13"	14.5
S-14	19¼"	2½"	2"	14"	16
S-15	19¼"	2"	2"	15"	16



PYROBAR ANGLE TILE

TYPE	F	H	T	WEIGHT
L-34	3"	4"	2"	15 Lbs.
L-45	4"	5"	2"	18.5
L-46	4"	6"	2"	20.

TYPE SHOE	Standard I-Beams	Bethlehem I-Beams	Bethlehem Girder Beams	Carnegie Beams
B-40 Max. Flange Width = 5"	6" 12.5#-17.25# 7" 15.5#-20# 8" 18.4#-25.5# 9" 21.8#-35# 10" 25.4#-30#			B-39
B-50 Max. Flange Width = 6"	10" 35#-40# 12" 31.8#-55# 15" 42.9#-55#	8" 17.5#-19# 9" 20.5#-24#		B-40 CB101 21#-30# CB121 25# CB141 30# CB161 35# 38#
B-65 Max. Flange Width = 7½"	15" 60.8#-75# 18" 54.7#-96# 20" 65.4#-100# 24" 79.9#-100#	10" 21#-28.5# 12" 25#-48.5# 15" 36#-59.5#		CB 82 24#-30# CB 92 29#-35# CB122 28#-36# CB142 33#-42# CB162 40#-50# CB181 47#-58#
B-80 Max. Flange Width = 9"	24" 105#-120# 27" 90#	15" 71.5# 18" 47#-74# 20" 56#-78# 22" 70#-79.5# 24" 58#-73#	8" 29.5#-36.5# 9" 36#-43.5# 10" 41.5#-50#	CB 83 31#-72# CB 93 38#-48# CB102 31#-42# CB103 49# CB123 40#-50# CB143 48#-58# CB163 58#-68# CB182 67#-78# CB211 60#-70# CB212 80# CB241 70#

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MASTER SPECIFICATIONS
PYROBAR BEAM AND GIRDER FIREPROOFING

Note: *Notes are explanatory or advisory only and should not be included in the specifications.*

Note: *Where Pyrobar Beam and Girder Fireproofing is used in conjunction with Pyrobar Partitions, Furring and Column Covering, these specifications may be merged with the Master Specifications given on pages 24 and 25 and clauses here given added where they apply.*

(1) Work Included

All steel *(beams) (girders) (trusses)* shall be protected with precast gypsum fireproofing.

Note: *If there are any exceptions, so note. List and locate any special requirements not clearly indicated on plans and details.*

(2) Materials

(2a) Fireproofing—All fireproofing shall be Pyrobar Beam Shoe, Angle and Soffit Tile, and Pyrobar (2 in. solid) (3 in. hollow) Partition Tile as made by the UNITED STATES GYPSUM COMPANY. All steel shall be protected with a minimum of 2 in. of precast gypsum.

(2b) Mortar—***Note:*** *Same as "Mortar" under "Materials," page 16.*

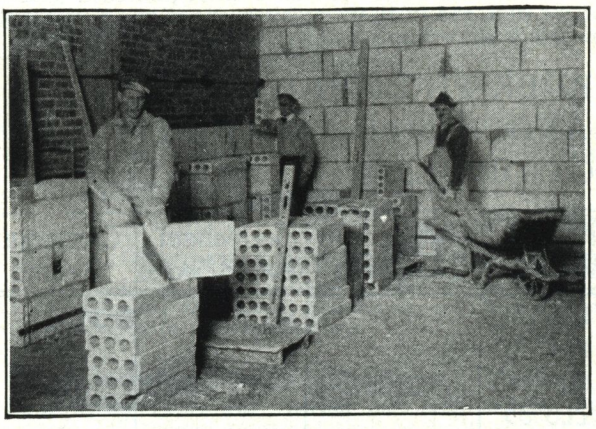
(3) Erection

(3a) By United States Gypsum Company—All fireproofing shall be completely erected by the UNITED STATES GYPSUM COMPANY'S Contracting Division.

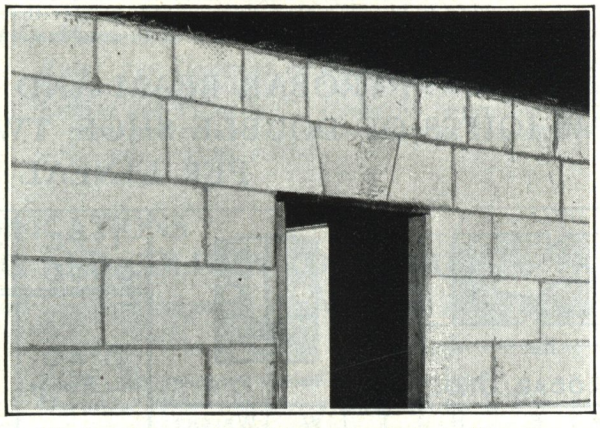
(3b) General—All fireproofing shall be erected in strict accordance with the UNITED STATES GYPSUM COMPANY'S standard details. All units shall be laid in gypsum mortar with full flush joints, true to line and plumb. Joints in alternate courses shall be broken.

Weight of Fireproofing per Lin. Ft. of Beam in Lb.

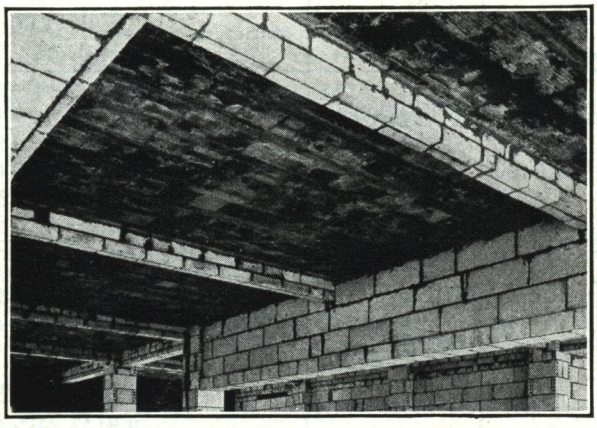
Size member	Precast Gypsum	Clay Tile	Concrete
6 in. I	19	33	60
7 in. I	21	36	71
8 in. I	23	39	93
9 in. I	25	43	95
10 in. I	27	47	118
12 in. I	30	51	131
15 in. I	35	60	168
18 in. I	42	68	208
20 in. I	44	73	234
21 in. I	48	79	293
24 in. I	52	85	297
27 in. I	58	96	392



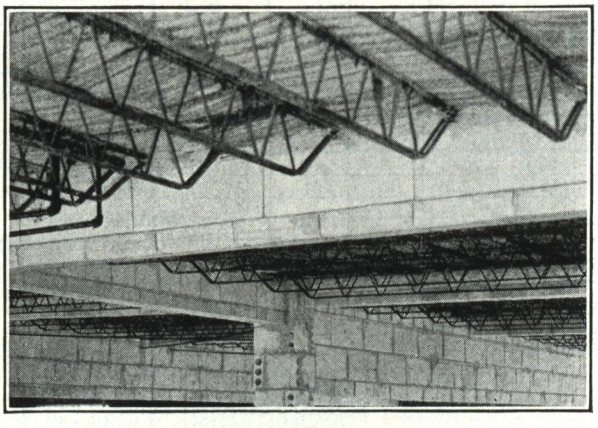
Erecting Pyrobar Partitions and Furring
Note ease of sawing and handling



Typical Pyrobar Partition Installation—Showing Standard Jack-arch



Application of Pyrobar Beam, Girder and Column Covering



Pyrobar Beam and Girder Covering in Connection with Steel Joist Floors

PYROBAR PARTITIONS AND FIREPROOFING

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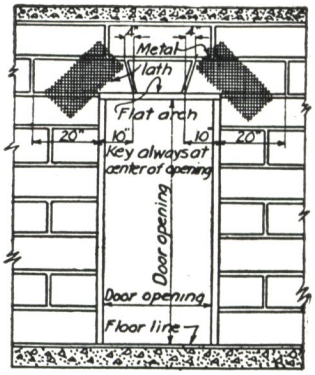
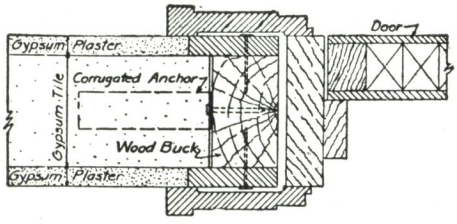
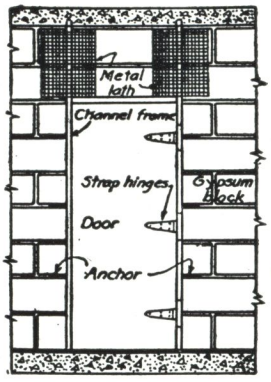
CONSTRUCTION DETAILS PYROBAR PARTITION TILE



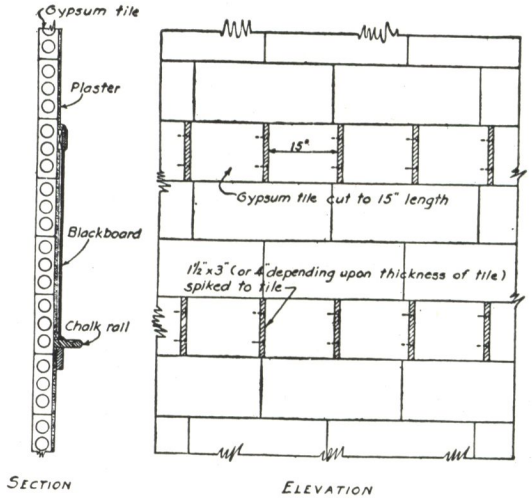
DETAIL SHOWING JACK ARCH CONSTRUCTION



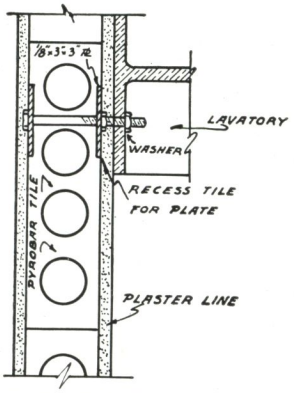
SECTION OF DOOR JAMB SHOWING WOOD BUCK



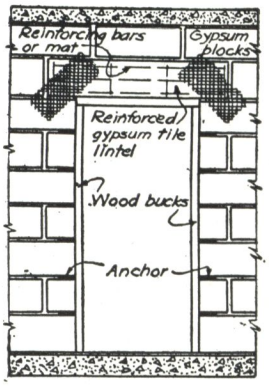
DETAIL OF DOOR WITH CHANNEL IRON FRAME



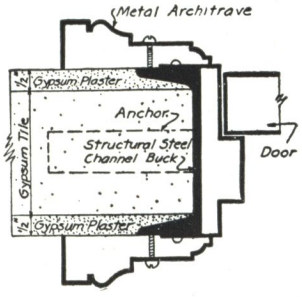
METHOD OF FASTENING SLATE BLACKBOARDS



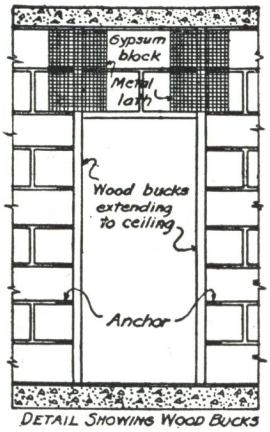
METHOD OF SUPPORTING LAVATORY ON PYROBAR PARTITIONS.



DETAIL SHOWING REINFORCED GYPSUM LINTEL CONSTRUCTION



SECTION OF DOOR JAMB SHOWING METAL BUCK



DETAIL SHOWING WOOD BUCKS

DETAILS—PYROBAR PARTITIONS